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IUE/IRA SYSTEM
DESCRIPTION AND
FINAL REPORT

PREPARED FOR:
GODDARD SPACE
FLIGHT CENTER
GREENBELT,
MARYLAND

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IUE/IRA SYSTEM DESCRIPTION AND FINAL REPORT

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LK/DL

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ABSTRACT

The information contained in this document consists of inputs from several IUE/IRA project personnel.

The major sections describe the basic system, its operation, options and parameters.

The Appendix summarizes the test data obtained from the Flight Unit during its ATP.

1.0 INTRODUCTION

The IUE/IRA System is a rate sensor system designed to meet the requirements of the NASA International Ultraviolet Explorer spacecraft mission. The system consists of two units, a Sensor Unit and an Electronic Control Unit. The Sensor Unit (SU) contains six rate sensor modules. The Electronic Control Unit contains the rate sensor support electronics and the command/control circuitry. Together they form an Inertial Reference Assembly (IRA) which will provide spacecraft rate (or delta position) information for use in the stabilization and control system.

The IUE/IRA is designed to meet objectives of a three year mission with an ultimate goal of five years. Highly reliable electronics and sufficient functional redundancy is provided in order to meet these goals.

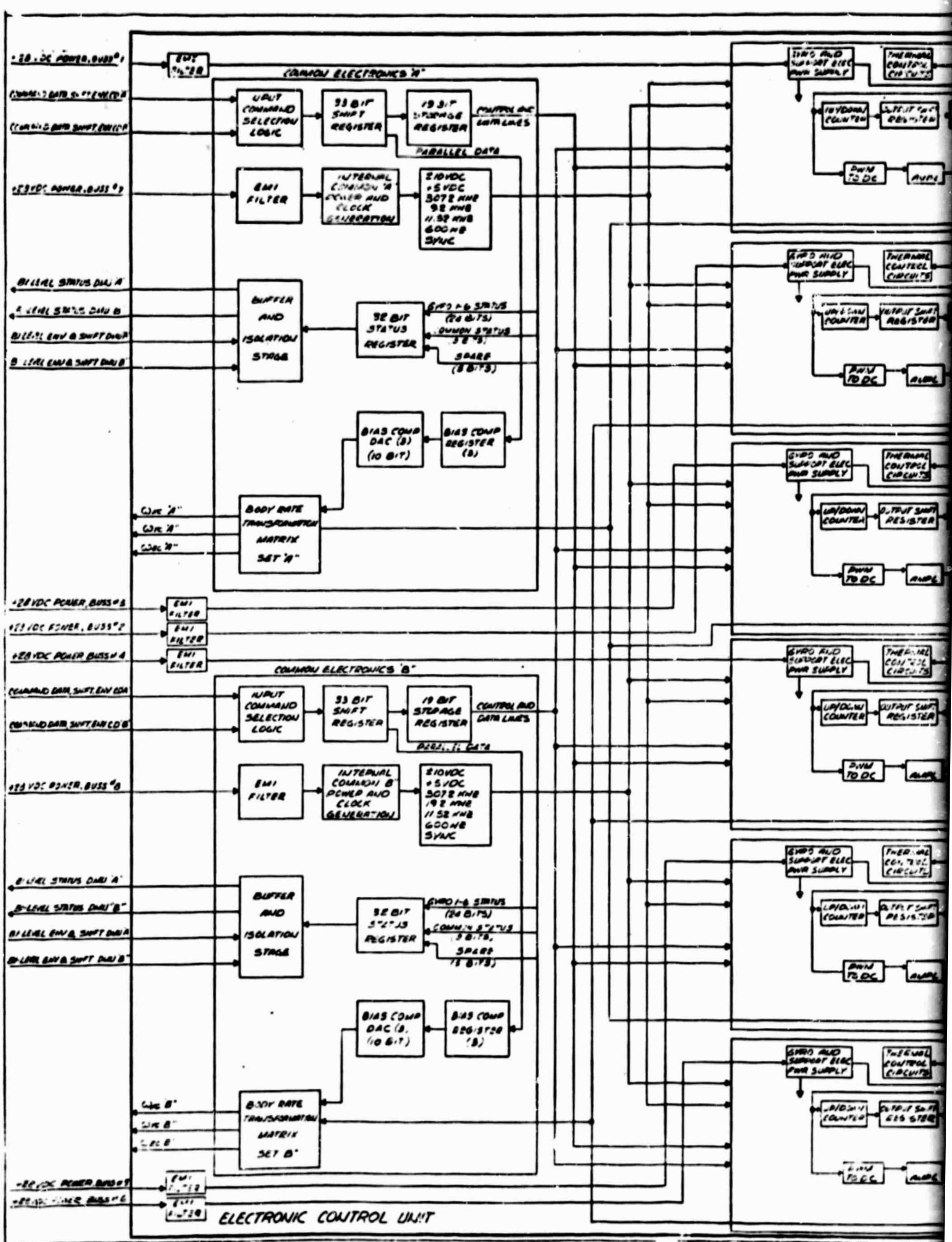
The succeeding paragraphs will describe the system in terms of functional description, operation, redundancy performance, mechanical configuration, weight, power, mechanical interface and electrical interface.

2.0 SYSTEM BLOCK DIAGRAM

Two block diagrams were generated in order to fully describe the IRA system. They are shown in figures 2-1 and 2-2. Figure 2-1 illustrates a top level breakout of the units with minimal definition. The system is divided into two packages, one containing only the rate sensors and one containing the supporting electronics.

The rate sensor package, called the Sensor Unit, consists of six 64 PM-RIG gyro units each having a pulse rebalance loop mechanization integral within the overall gyro dimensions. The rebalance loop electronics are mounted integral with the gyro in order to provide a rate sensor module which is temperature stabilized and functionally interchangeable with other units. The gyro itself is a fluid floated unit containing a hydrodynamic spin motor bearing.

The supporting electronics package, called the Electronic Control Unit contains a redundant set of command/control electronics, known as the "common electronics" and the required circuits to fully support the rate sensors. This unit contains twelve (12) electronic circuit cards. They are grouped as follows:



FOLDOUT FRAME

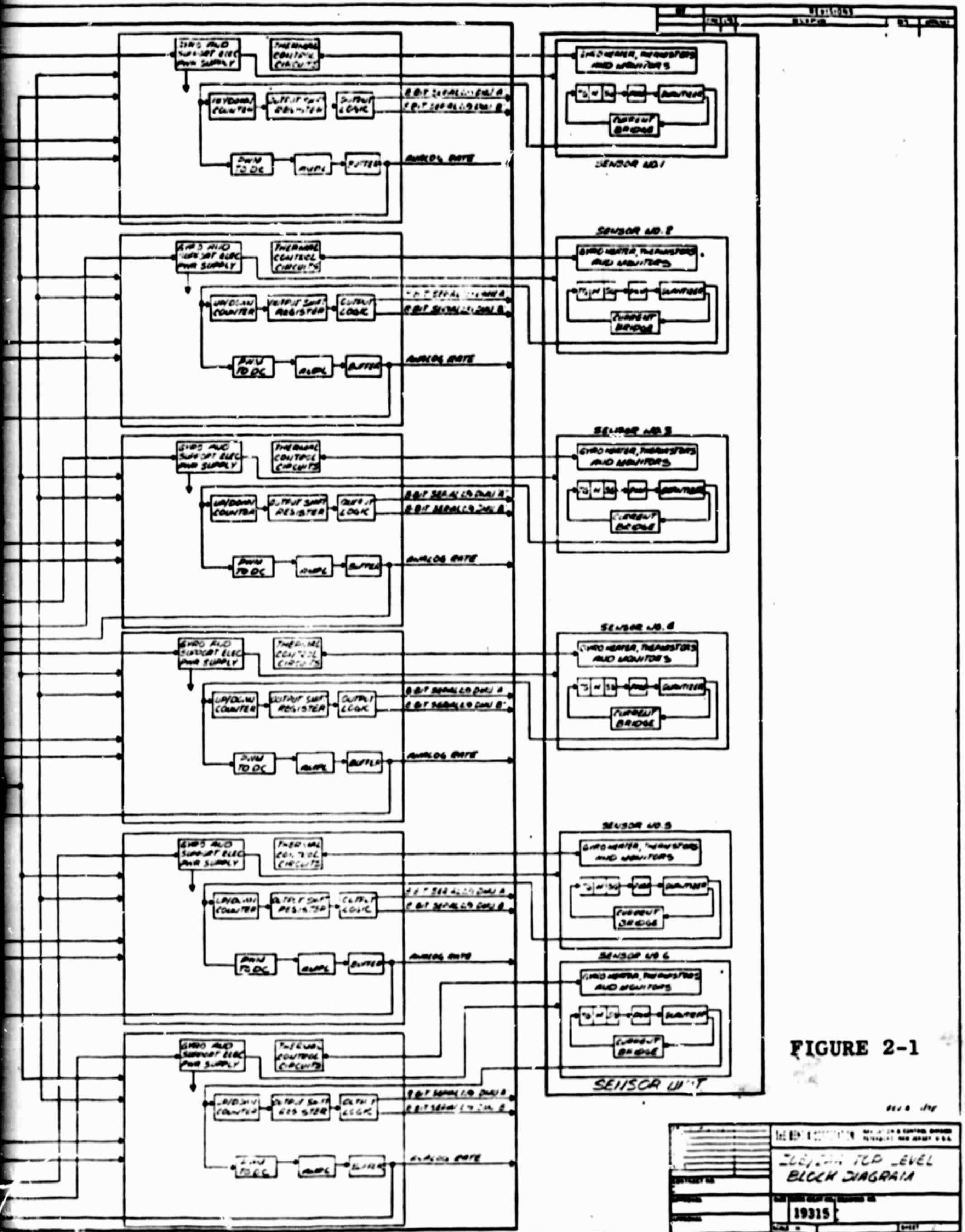


FIGURE 2-1

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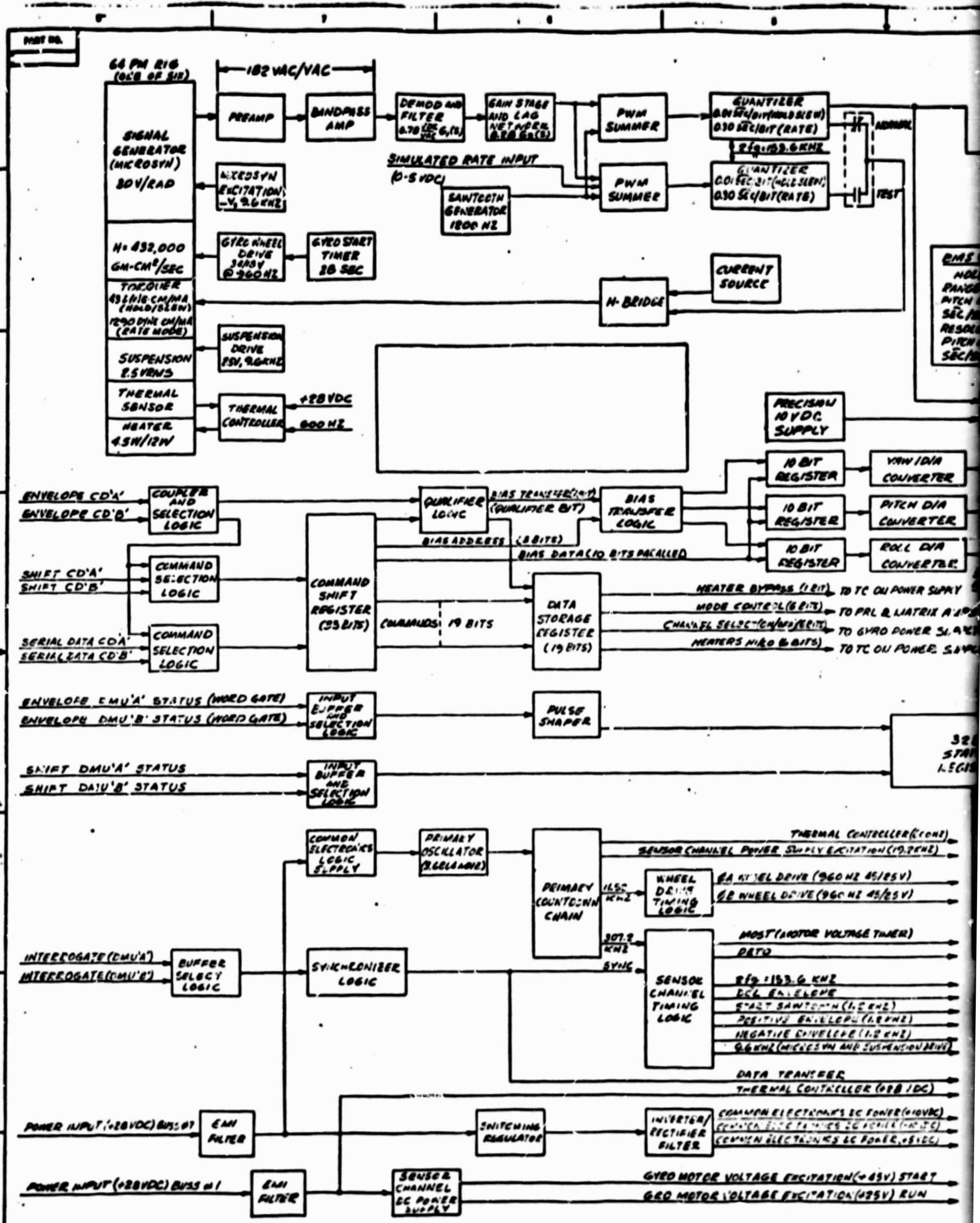

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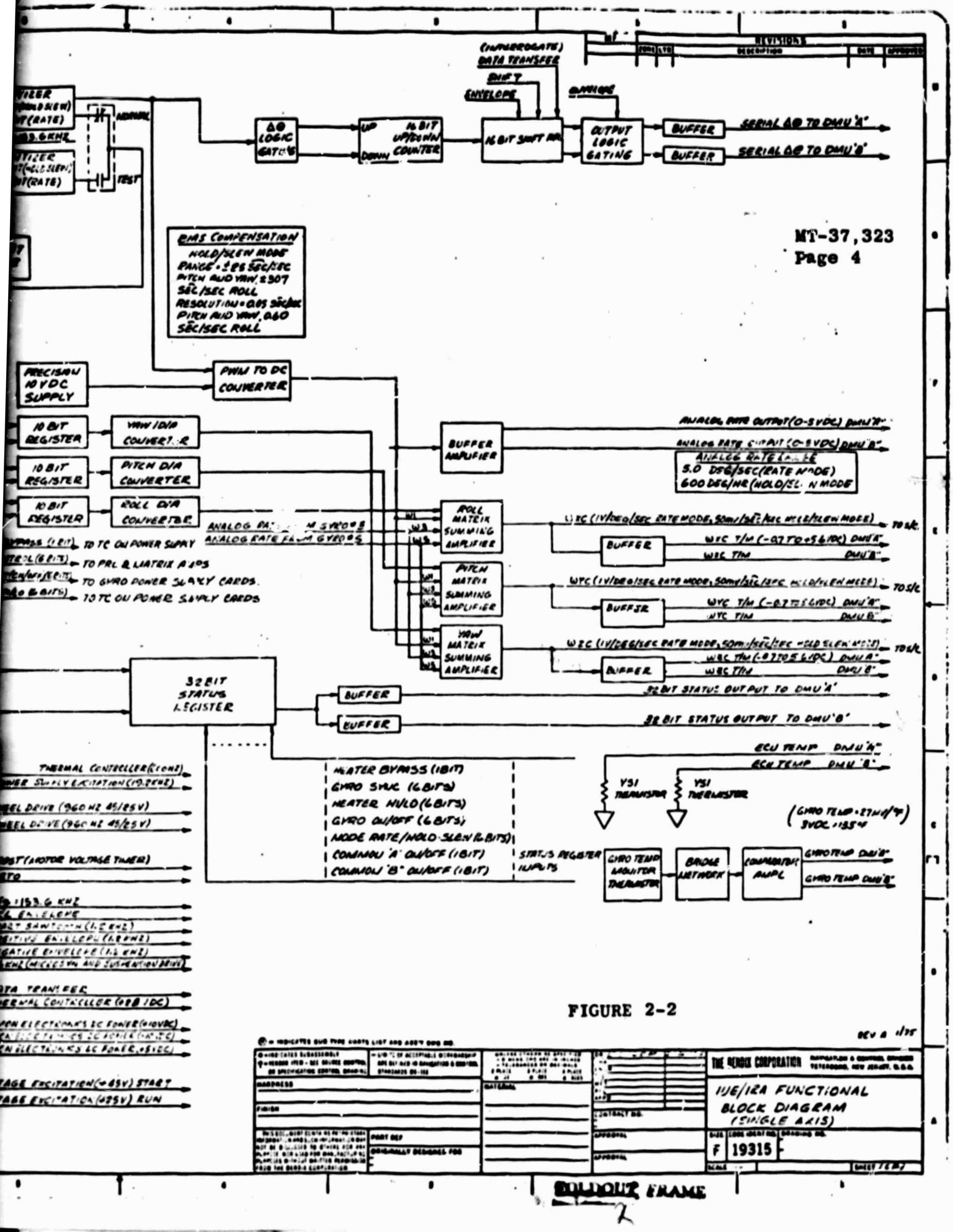
(INTERROGATE) DATA TRANSFER
SHIFT
ENVELOPE
ENABLE
ΔΘ LOGIC GATING
UP
DOWN
16 BIT UP/DOWN COUNTER
16 BIT SHIFT REG
OUTPUT LOGIC GATING
BUFFER
SERIAL ΔΘ TO DMU 'A'
BUFFER
SERIAL ΔΘ TO DMU 'B'
NORMAL
TEST
RMS COMPENSATION
HOLD/SLEW MODE
RANGE ±.285 SEC/SEC
PITCH AND YAW, ±307
SEC/SEC ROLL
RESOLUTION ± 0.05 SEC/SEC
PITCH AND YAW, 0.60
SEC/SEC ROLL
PRECISION 10 VDC SUPPLY
PWM TO DC CONVERTER
10 BIT REGISTER
YAW D/A CONVERTER
10 BIT REGISTER
PITCH D/A CONVERTER
10 BIT REGISTER
ROLL D/A CONVERTER
BUFFER AMPLIFIER
ANALOG RATE OUTPUT (0-5VDC) DMU 'A'
ANALOG RATE OUTPUT (0-5VDC) DMU 'B'
ANALOG RATE SCALE
5.0 DEG/SEC (RATE MODE)
600 DEG/HR (HOLD/SLEW MODE)
ANALOG RATE FROM GYRO'S
ROLL MATRIX SUMMING AMPLIFIER
PITCH MATRIX SUMMING AMPLIFIER
YAW MATRIX SUMMING AMPLIFIER
BUFFER
TO S/C
TO TC ON POWER SUPPLY
TO PRL & MATRIX A/D'S
TO GYRO POWER SUPPLY CARDS
TO TC ON POWER SUPPLY CARDS
32 BIT STATUS REGISTER
BUFFER
32 BIT STATUS OUTPUT TO DMU 'A'
BUFFER
32 BIT STATUS OUTPUT TO DMU 'B'
ECU TEMP DMU 'A'
ECU TEMP DMU 'B'
YSI THERMISTOR
YSI THERMISTOR
HEATER BYPASS (1 BIT)
GYRO SYNC (6 BITS)
HEATER HI/LO (6 BITS)
GYRO ON/OFF (6 BITS)
MODE RATE/HOLD-SLEW (6 BITS)
COMMON 'A' ON/OFF (1 BIT)
COMMON 'B' ON/OFF (1 BIT)
STATUS REGISTER INPUTS
GYRO TEMP MONITOR THERMISTOR
BRIDGE NETWORK
COMPARATOR AMPL
GYRO TEMP DMU 'A'
GYRO TEMP DMU 'B'
THERMAL CONTROLLER
FIGURE 2-2
THE XEROX CORPORATION
11/E/12A FUNCTIONAL BLOCK DIAGRAM (SINGLE AXIS)
F 19315
FOLDOUT FRAME

2.0 (continued)

- o Common Electronics - 2 cards; one complete set per card; contains the common electronics power supply, system reset logic, main oscillator and countdown chain, command decoder interface, command generation, storage registers, status register interface, status register, interrogate conditioning logic and the pitch, yaw and roll body rate telemetry buffer amplifiers.
- o Gyro Channel Power Supply and Temperature Controller - 3 cards; each card supports two rate sensors; contains the temperature controller hybrid circuit and drive stage, heater mode switching relays, logic for heater switching, transformer, inverters and conditioning for gyro power generation and channel select logic.
- o Support Electronics - 3 cards; each card supports two rate sensors; contains the two phase gyro wheel drive circuitry, microsyn excitation and monitor, spin motor sync detector, gyro temperature monitor conditioning amplifier, suspension drive and monitor.

- o Control Electronics - 3 cards; each card supports two rate sensors; contains the $\Delta\Theta$ output register, 16 bit up-down counter, output logic, logic circuitry for the data, envelope, shift and interrogate, precision 10VDC supply for PWM to DC conversion, timing logic and analog rate telemetry output.
- o Matrix Amplifiers - one card; supports both common electronics cards; contains the digital to analog converter for bias compensation generation, bias compensation amplifiers, body rate matrix amplifiers and gain switching mechanization for the matrix amplifiers.

The common electronics each address all six rate sensors. The ability is provided to switch from one set of common electronics to the other and to command any combination of rate sensors into operation. This is more fully described in the system operation section.

Figure 2-2 illustrates the IRA system on a single axis basis, that is, one set of common electronics, one rate sensor and one set of rate sensor supporting electronics. Major electrical functions are described in the following sub-sections.

2.1 Digital Data Output ($\Delta\Theta$)

The gyro senses vehicle rate which is converted through hybrid circuitry to PWM format and then quantized. The up/down counter accumulates the quantized pulses which represent the net torque required to rebalance the gyro float (a measure of the net displacement). This information is shifted to the output register and gated to the appropriate Data Multiplex Unit upon command. The output is 8 bit serial data representing $\Delta\Theta$ with two 8 bit segments necessary to obtain one full data word. The up-down counter is sixteen bits in length and operates in 2's complement form. Thus it counts up to $\pm$16,384 bits. There is no saturation detection logic required and the counter will increment in the positive direction through saturation to the next binary number (a negative number in 2's complement). The spacecraft computer algorithm will operate on the data and determine the change in inertial position (or rate) by insuring that it sample the data at a rate faster than the time required to overflow the up-down counter for that particular mode. The spacecraft sampling rate is defined as 2-160 times per second. The fastest rate the IRA may be sampled is once every duty cycle or 1200 times per second. The two 8 bit output registers are connected in a non-destruct read fashion, that is, the data is shifted out and recycled back into the register prior to the

next interrogate. This allows continuous sampling of the same register contents without update. The sampling rate is not restricted by the IRA and any rate sensor may be sampled in any sequence.

In addition, no data is lost in transmission during the sampling time. This is accomplished as follows: The fundamental frequency f_s is 1200 Hz. The quantizing frequency, 2fq is 153.6KHz. Therefore, there are 128 pulses or time slots within each 1/1200 sec. interval (64 positive and 64 negative). Eight pulses of the 64 are reserved for "housekeeping" functions resulting in a duty cycle of 56/64 or 87.5% for data. It is during the remaining 12.5% of the time that the data in the up-down counter is interrogated (shifted to the output registers).

Saturation of the quantized PWM operation occurs at $\pm$672 arc seconds per second in the hold/slew mode and $\pm 5.6^{o}$ per second in the rate mode. Quantization level is 0.01 arc sec per bit in the hold (slew mode and 0.30 arc sec per bit in the rate mode. The analog outputs (body matrix amplifiers and analog rate) are scaled such that saturation occurs at lower levels.

2.2 Body Rate Matrix Outputs, Rate Output

Two forms of analog rate are available at the IRA interface, spacecraft body rates and individual gyro rates.

The spacecraft body rates are determined by summing the outputs of rate sensors 1, 3 and 5 with appropriate magnitude and sign into a set of amplifiers called the matrix amplifiers. There is one such circuit for each of pitch, yaw and roll. A second set of body rates is generated from rate sensors 2, 4 and 6 when common electronics B is used. The ranges and scaling of these outputs are shown in Table 2-1.

	RATE MODE		HOLD/SLEW MODE	
Axis	Body Rates (deg/sec)	Scale Factor vdc/deg/sec	Body Rates (arc sec/sec)	Scale Factor vdc/arc sec/sec
Pitch	±5	1.0	±600	0.050
Yaw	±5	1.0	±600	0.050
Roll	±60	1.0	±7200	0.050

TABLE 2-1 MATRIX PARAMETERS

Saturation occurs at ±5VDC which corresponds to the maximum rate in the rate mode but only ±100 arc seconds per second in the hold/slew mode. A better resolution is required for these outputs in this particular mode.

A check on the rate levels for either rate or hold/slew mode may be made by monitoring the individual gyro rate outputs. These outputs are available on telemetry and are scaled such that ±5 degrees per second and ±600 arc seconds per second equals 2.5VDC ± 2.5VDC (that is 0-5VDC centered at 2.5).

2.3 Bias Compensation Generation

A circuit function is provided to bias the outputs of the matrix amplifiers. Ten bits of the input command word are used in 2's complement form to generate a maximum bias of ±25.6 degrees per hour to pitch and yaw and ±307.2 degrees per hour to roll in the hold/slew mode. Resolution is 0.05 arc second per bit, pitch and yaw, and 0.60 arc second per bit in roll. The bias compensation feature is not eliminated in the rate mode but does change by the matrix scaling change. Range and resolution for pitch and yaw in the rate mode are 0.213 degrees per second and 1.5 arc seconds, respectively. Range and resolution for roll are 2.56 degrees per second and 18 arc seconds, respectively.

2.4 Pulse Rebalance Loop

The pulse rebalance loop of each of the six rate sensors consists of six hybrid modules; a preamp and bandpass filter, demodulator and notch filter, gain change and buffer

amplifier, sawtooth generator and dual quantizer, torquer current source, and torquer H-bridge. These six hybrids are physically mounted to the signal generator end of the gyro and consequently become temperature stabilized with the gyro. The 2nd half of the dual quantizer is used for the simulated torquing test condition. In that mode the feedback to the torquer H-bridge is switched from the normal output quantizer to the test quantizer. An analog input is commanded to the test PWM and the gyro is rebalanced (the signal sum at the test PWM is zero). The normal PWM and quantizer will then read the commanded rate by outputting $\Delta\theta$ information through the normal output chain.

The frequency of operation of the quantizer (1200Hz) is high enough when compared to the bandwidth of the loop (approx. 7.5 Hz in the hold/slew mode) that the pulse rebalance loop can be considered essentially linear. The nominal closed loop transfer functions for the two modes of operation are shown in Table 2-2. Detailed analysis of the bandwidth and stability criteria is given in MT 37,308.

MODE / TEMP	RATE	HOLD/SLEW
80 °F	$\dfrac{\left(\frac{S}{6.28}+1\right)}{\left[\left(\frac{S}{8.27}\right)^2+\frac{2(.69)S}{8.27}+1\right]\left[\frac{S}{1010}+1\right]}$	
135 °F	$\dfrac{\left(\frac{S}{6.28}+1\right)}{\left(\frac{S}{6.33}+1\right)\left(\left(\frac{S}{625}\right)^2+\frac{2(.21)S}{625}+1\right)}$	$\dfrac{\left(\frac{S}{6.28}+1\right)}{\left(\frac{S}{8.23}+1\right)\left(\frac{S}{26.2}+1\right)\left(\frac{S}{640}+1\right)}$

TABLE 2-2 NOMINAL CLOSED LOOP TRANSFER FUNCTIONS FOR THE PULSE REBALANCE LOOP

The remaining information on Figure 2-2 describes functionally the system power and timing generation and the status register monitor (see Table 2-3 for status register definition). Details are given on the gyro parameters and pulse rebalance characteristics. Additional scaling, weighting, signal ranges and li its will be added to the block diagram during future updates.

3.0 SYSTEM OPERATION

3.1 Launch and Transfer Orbit

During launch and transfer orbit the IRA common electronics and rate sensors will be off. Power (limited) will be applied to all six rate sensor heaters. This power is applied by commanding six of the eight spacecraft +28V buss lines to the IRA to be energized. By closing those relays, power will be applied directly to the rate sensor thermal controllers. The thermal controllers will be preset to a latched state that will energize a 4.5 watt heater winding on each gyro. The gyro heaters front end electronics and EMI filters will draw a total of 30.0 watts in this mode (assuming all gyros are below the steady state 135°F).

TABLE 2-3

STATUS REGISTER SIGNALS

BIT NO.	FUNCTION	STATE
1	Not Used	---
2	Not Used	---
3	Not Used	---
4	Not Used	---
5	Control Bit	"1"=On
6	Rate Cold Mode	"1" =Off
7	Gyro No. 6 Sync/No Sync	"1"=Sync
8	Gyro No. 5 Sync/No Sync	"1"=Sync
9	Gyro No. 4 Sync/No Sync	"1"=Sync
10	Gyro No. 3 Sync/No Sync	"1"=Sync
11	Gyro No. 2 Sync/No Sync	"1"=Sync
12	Gyro No. 1 Sync/No Sync	"1"=Sync
13	Common "A" On/Off	"1"=On
14	Common "B" On/Off	"1"=On
15	Gyro No. 1 Heater Hi/Lo	"1"= Lo
16	Gyro No. 2 Heater Hi/Lo	"1"= Lo
17	Gyro No. 3 Heater Hi/Lo	"1"= Lo
18	Gyro No. 4 Heater Hi/Lo	"1"= Lo
19	Gyro No. 5 Heater Hi/Lo	"1"= Lo
20	Gyro No. 6 Heater Hi/Lo	"1"= Lo
21	Gyro Channel No. 1 On/Off	"1"=On
22	Gyro Channel No. 2 On/Off	"1"=On
23	Gyro Channel No. 3 On/Off	"1"=On
24	Gyro Channel No. 4 On/Off	"1"=On
25	Gyro Channel No. 5 On/Off	"1"=On
26	Gyro Channel No. 6 On/Off	"1"=On

TABLE 2-3 STATUS REGISTER SIGNALS (continued)

BIT NO.	FUNCTION	STATE
27	Gyro No. 1 Mode, Hold-Slew/Rate	"1"=Hold-Slew
28	Gyro No. 2 Mode, Hold-Slew/Rate	"1"=Hold-Slew
29	Gyro No. 3 Mode, Hold-Slew/Rate	"1"=Hold-Slew
30	Gyro No. 4 Mode, Hold-Slew/Rate	"1"=Hold-Slew
31	Gyro No. 5 Mode, Hold-Slew/Rate	"1"=Hold-Slew
32	Gyro No. 6 Mode, Hold-Slew/Rate	"1"=Hold-Slew

TOTAL = 32

TOTAL USED = 28

SPARES = 4

As Figure 3-1 shows, the common electronics in the IRA (both sets) draw power from separate busses (No. 7 and No. 8). This method of implementation eliminates the use of impulse commands, allows power to be supplied to gyro heaters without energizing the common electronics and adds to the overall system reliability by reducing the possibility of a multiple failure caused by a short on a power line.

It should be noted that during this mode the thermal controllers are not operating in their normal Pulse Width Modulated state but are operating in an open loop hard-over arrangement. This implementation minimizes power losses and maximizes heat delivered to the gyros.

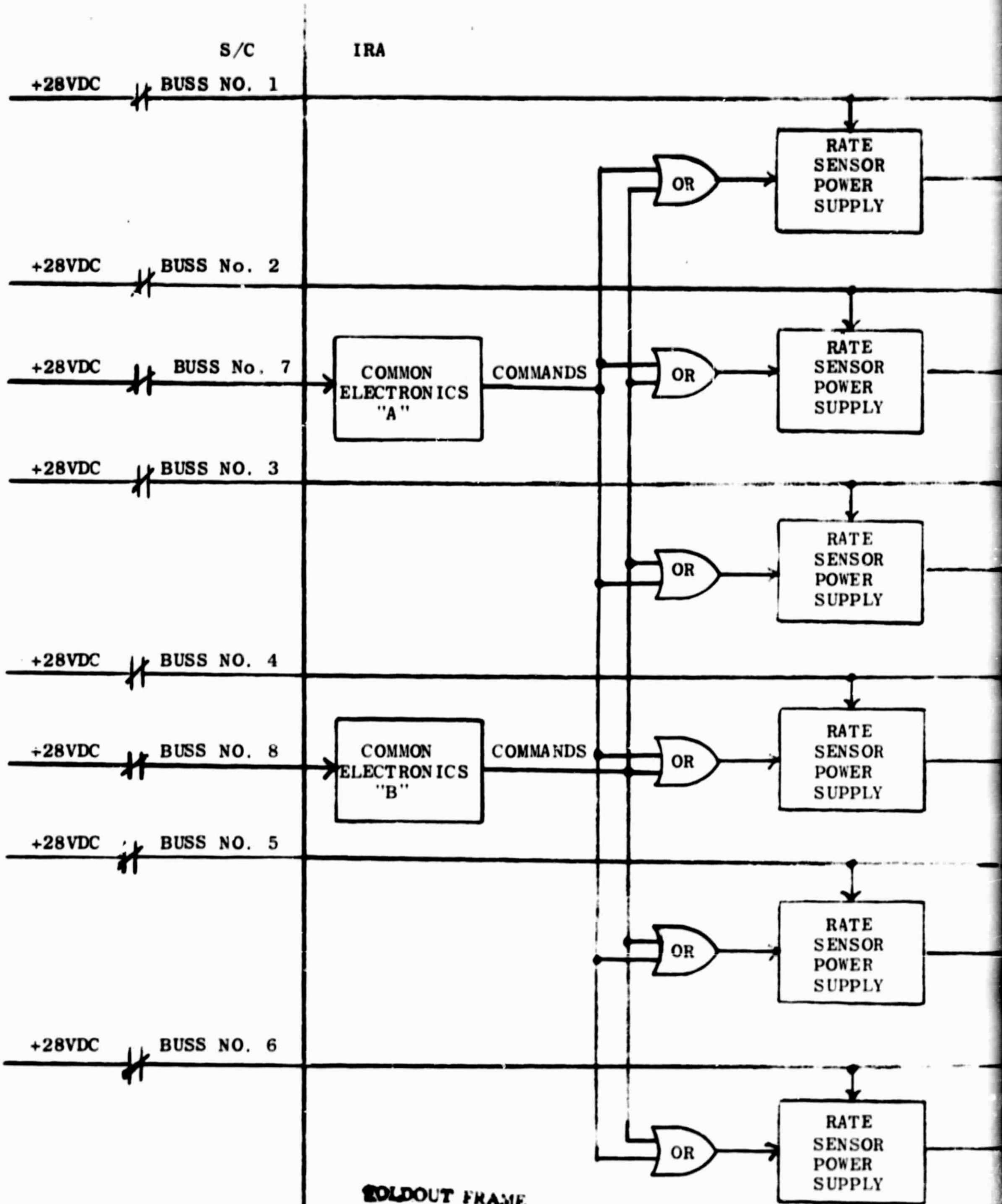

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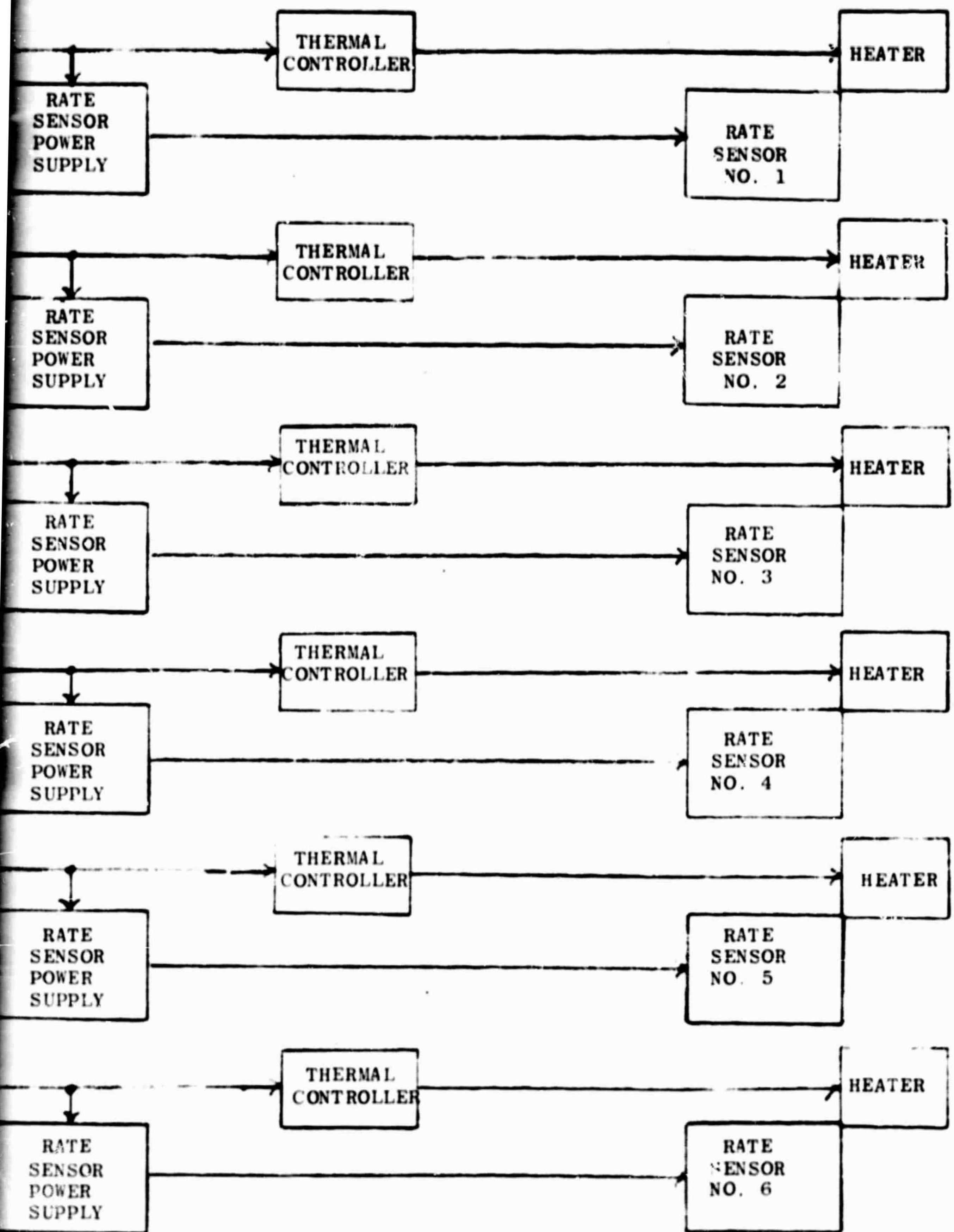
FIGURE 3-1 SIMPLIFIED IN



1 SIMPLIFIED INTERFACE

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2

3.2 Initialization On-Oribt

With

30 watts of power available for heating, the steady state non-operating temperature is in the neightborhood of 70°F. Therefore, when the system is fully energized the heaters will still be in a hard-over condition.

To energize the system either Buss No. 7 or Buss No. 8 must be activated by the spacecraft. Closing either of these relays will energize the common electronics power supply (Buss No. 7 for Common "A", Buss No. 8 for Common "B").

The "come up" state of the common electronics is as follows:

- o All gyro channels come up off
- o Gains are set to the rate mode condition
- o Gyro heaters come up in the 4.5 watt state (should be in this state from transfer orbit)

- o Status register will indicate present states
- o Bias compensation will be reset to zero bias, all axes

o Gyro sync detectors are reset to "no sync"

o Matrix amplifier gains are set to rate mode (condition is - if any rate sensor is in the hold/slew mode then the matrix gain is set to hold/slew).

In general, the input holding registers for the command word are held low during power turn-on. Commands may now be issued to the IRA through the Command Decoder Interface. All IRA commands are issued in this manner. No impulse commands are used.

An option is also provided at this time to initiate the high heater state to one or more gyros. If power is available, the 12 watt heater state can be used to stabilize the IRA in a shorter period of time.

The rate sensors may now be energized. Each rate sensor is energized separately through the channel select command bits. The initial starting power for each rate sensor

is shown in Figure 3-3. The voltage applied to the gyro wheel during start is 34 VRMS at 960 Hz. To limit power drawn from the spacecraft the rate sensors should be energized sequentially. Power drops off significantly as the gyro wheel reaches sync but still remains higher than the run power until the excitation voltage is reduced to 18VRMS. This occurs 28 seconds after the on command is issued.

The expected sequence is to energize all six rate sensors sequentially, remaining in the rate mode of operation. The spacecraft will then be despun. If necessary, three rate sensors may then be commanded off to conserve power until a sun fixed attitude is obtained. When full power is available the three rate sensors will be energized again and the hold/slew mode commanded. Normal spacecraft experiments will commence when the IRA has been stabilized at 135^{o}F.

3.3 Mode Control Flexibility

The IRA mode options are discussed in the following sections.

3.3.1 Hold/Slew vs. Rate

The gyros may be commanded through the serial link to be in either the hold/slew mode or rate mode individually.

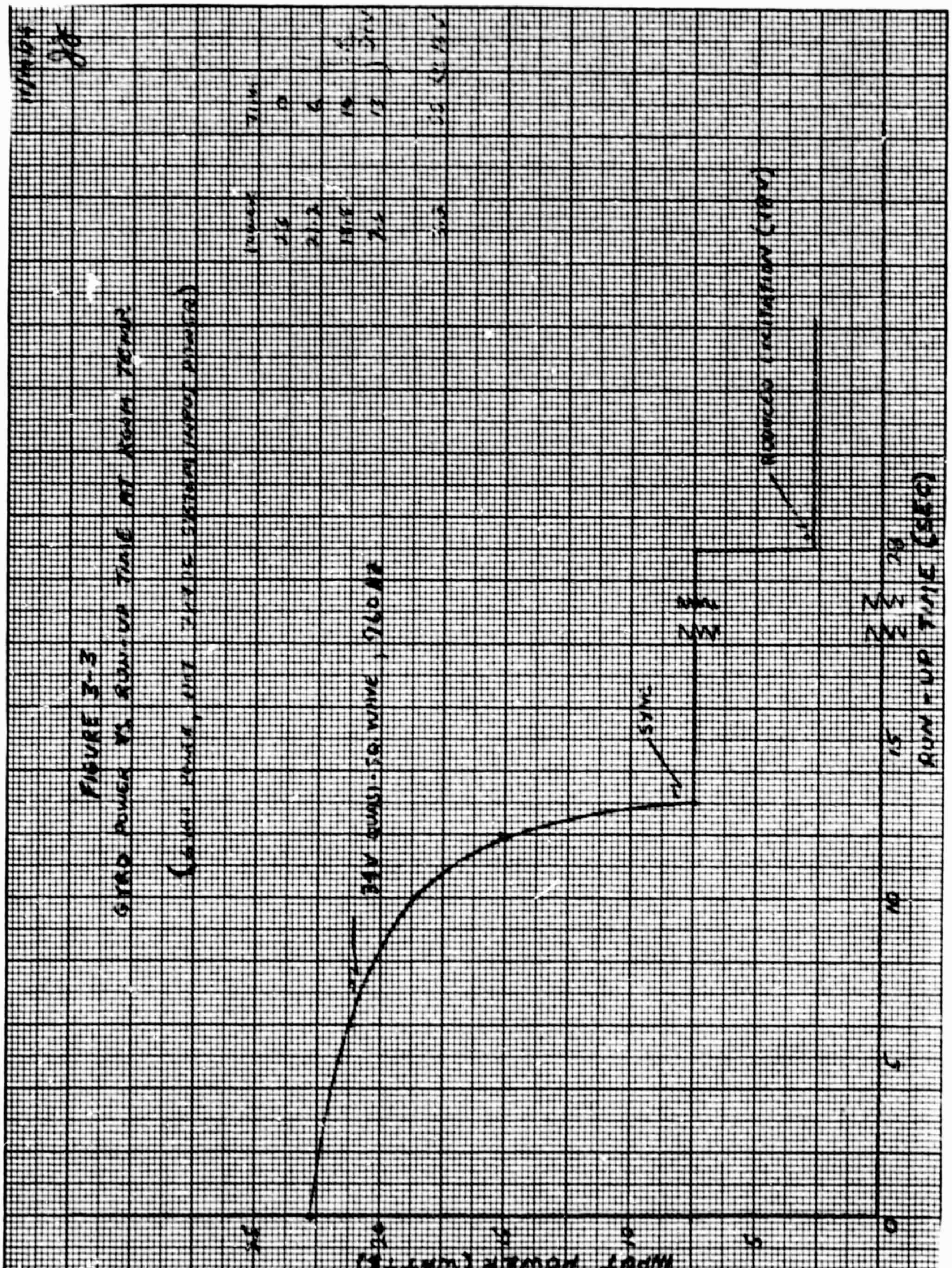


FIGURE 3-3
RUN-UP TIME (SEC)
INPUT POWER (WATTS)
SYNC

The matrix amplifiers are set to the hold/slew gain when any gyro is commanded to the hold/slew mode. There are two sets of matrix amplifiers, one associated with the use of each common electronics. Analog rate from gyros 1, 3, 5 is used in conjunction with the matrix amplifiers in common electronics "A". Rate from gyros 2, 4, 6 is used to generate body rate when common electronics "B" is used.

3.3.2 Gyro On/Off

Any gyro may be commanded on or off individually through the common electronics via the serial link. This control is independent of the associated gyro heater.

3.3.3 Heater Control

The gyro heaters have two power ranges; 4.5 and 12 watts. The heaters consist of two windings a 4.5 watt winding and a 7.5 watt winding. The 4.5 and 12 watt ranges are determinedby opening or closing a latch device in series with the 7.5 watt winding. The system is designed such that the heaters can be individually switched to the 4.5 watt state or the 12 watt state.

3.3.4 System On/Off

The IRA System can be deenergized completely only through the spacecraft buss relays (eight). These relays override the common electronics control and in the case of buss no. 7 and no. 8 remove all power from the common electronics.

The on/off mechanization is as follows: Busses 1-6 are energized to apply heater power to the gyro heaters and to make power available to the gyro power supplies. The gyro power supplies (and the rate sensors) are not energized until the common electronics is powered (by buss no. 7 or no. 8) and commands issued. If the entire system was on and the buss supplying the common electronics was switched off, all power would be removed from all rate sensors except heater power. The heater would be switched to the 4.5 watt state if it was originally in the 12 watt state.

If the common electronics was energized first and a command issued to energize a gyro and then the gyro buss energized, the gyro would come up in the state dictated by the common electronics.

It is possible to command both common electronics to the on condition simultaneously. If this occurs an interlock is provided that disables both frequency counters and essentially shuts the system off.
No damage will occur within the IRA but all information will be invalid.

3.3.5 Bias Compensation Control

Matrix bias compensation is performed by commanding appropriate bits through the Command Decoder interface. Three bits are reserved for matrix axis address, which allows each body axis to be biased individually. Ten bits are used for data, the format being 2's complement.

3.3.6 Command Word Structure

All the serial commands are derived from one 37 bit serial link. The IRA contains a 33 bit shift register thus accepting only bits 5-37. Table 3-1 defines the bit assignements. Bits 35-37 contain the address for bias compensation routing. Bits 25-34 contain the bias data. Bit 24 is a control bit or qualifier bit. When this bit is a "1" it will activate bit positions 5-23; when it is a "0" it will activate bits 25-37. The qualifier allows commands to be stored without having to command the same sections of a word repeatedly.

Bits 11-16 control the gyro on/off condition. Bits 5-10 are used for mode control, a "1" being Hold/Slew, a "0" identifying rate. Bits 17-22 are used to command the heaters to either the 4.5 or 12 watt state. BIT 23 commands the rate cold gain state for any gyro in the rate mode.

TABLE 3-1

COMMAND BIT ASSIGNMENT

BIT NO.	FUNCTION	STATE
37	Bias Address, Pitch	"1"=Active
36	Bias Address, Roll	"1"=Active
35	Bias Address, Yaw	"1"=Active
34	Bias Data LSB	
33	Bias Data	
32	Bias Data	
31	Bias Data	
30	Bias Data	
29	Bias Data	0.05 arc sec/bit weighting
28	Bias Data	
27	Bias Data	
26	Bias Data	
25	Bias Data MSB	
24	Qualifier Bit	"0"=Bias Information "1"=Command Change
23	Rate Cold Mode	"1"=On
22	Gyro No. 1 Heater Hi/Lo	"1"=12 Watt State
21	Gyro No. 2 Heater Hi/Lo	"1"=12 Watt State
20	Gyro No. 3 Heater Hi/Lo	"1"=12 Watt State
19	Gyro No. 4 Heater Hi/Lo	"1"=12 Watt State
18	Gyro No. 5 Heater Hi/Lo	"1"=12 Watt State
17	Gyro No. 6 Heater Hi/Lo	"1"=12 Watt State
16	Gyro Channel No. 1 On/Off	"1"=On
15	Gyro Channel No. 2 On/Off	"1"=On
14	Gyro Channel No. 3 On/Off	"1"=On
13	Gyro Channel No. 4 On/Off	"1"=On
12	Gyro Channel No. 5 On/Off	"1"=On
11	Gyro Channel No. 6 On/Off	"1"=On

TABLE 3-1 COMMAND BIT ASSIGNMENT (Continued)

BIT NO.	FUNCTION	STATE
10	Mode Control Gyro No. 1, Hold-Slew/Rate	"1"=Hold/Slew
9	Mode Control Gyro No. 2, Hold-Slew/Rate	"1"=Hold/Slew
8	Mode Control Gyro No. 3, Hold-Slew/Rate	"1"=Hold/Slew
7	Mode Control Gyro No. 4, Hold-Slew/Rate	"1"=Hold/Slew
6	Mode Control Gyro No. 5, Hold-Slew/Rate	"1"=Hold/Slew
5	Mode Control Gyro No. 6, Hold-Slew/Rate	"1"=Hold/Slew
4	Not Used	
3	Not Used	
2	Not Used	
1	Not Used	

3.3.7 Summary of Options

a) The rate sensors may be turned on and off independently through the IRA common electronics.

b) The rate sensors may be turned off independently through the spacecraft switched +28V lines.

c) The common electronics is energized through separate buss lines. No internal protection is provided against energizing both common electronics simultaneously.

d) Gyro mode selection is individual.

e) Heater mode (hi/lo) is individual.

f) Heaters may be operated without common electronics on (low heater only).

g) Duty cycle of heaters can be switched by switching the heaters from hi to lo or vice versa.

h) Many combinations of active rate sensors plus gyro heaters exist that will not violate the total power requirement.

4.0 REDUNDANCY ANALYSIS

The IRA, as designed, has extremely reliable piece parts and adequate redundancy to fulfill the IUE mission for the minimum three year period. Furthermore, the reliability prediction (Section 5.0) indicates an excellent five year capability.

This analysis will identify the major redundant functions and show how they interact to provide the necessary reliability. The analysis will be updated periodically to include secondary effects and insure that no single point failures exist. To date, no single point failures have been identified.

4.1 Input Power

Power to the IRA system is transmitted on eight separate busses; each buss with a redundant high wire and a total of four grounds. Each of busses 1-6 supports one gyro electronics, one gyro and one gyro heater. Busses 7 and 8 supply power to the common electronics.

Since the common electronics sections (two) are powered from separate busses and the six rate sensors powered from separate busses, there exists no single point failure in the input power scheme.

4.2 Command/Control

As was mentioned in previous sections the IRA has redundant sets of common electronics. These electronics receive input commands from two separate Command Decoders. These commands use interface circuitry which isolate one Command Decoder from the other and allow either a failed high or low condition without affecting the addressing capability (see figure 4-1).

Output data is buffered, thus eliminating a failed low condition from inhibiting the redundant output. A failure internal to the common electronics would necessitate a switch to the redundant set.

Figure 4-2 shows the functional partitioning of the IRA into electronic card types and the functions contained on each card. Every electronic card is identical to at least one other electronic card or section on that card. Total redundancy is present.

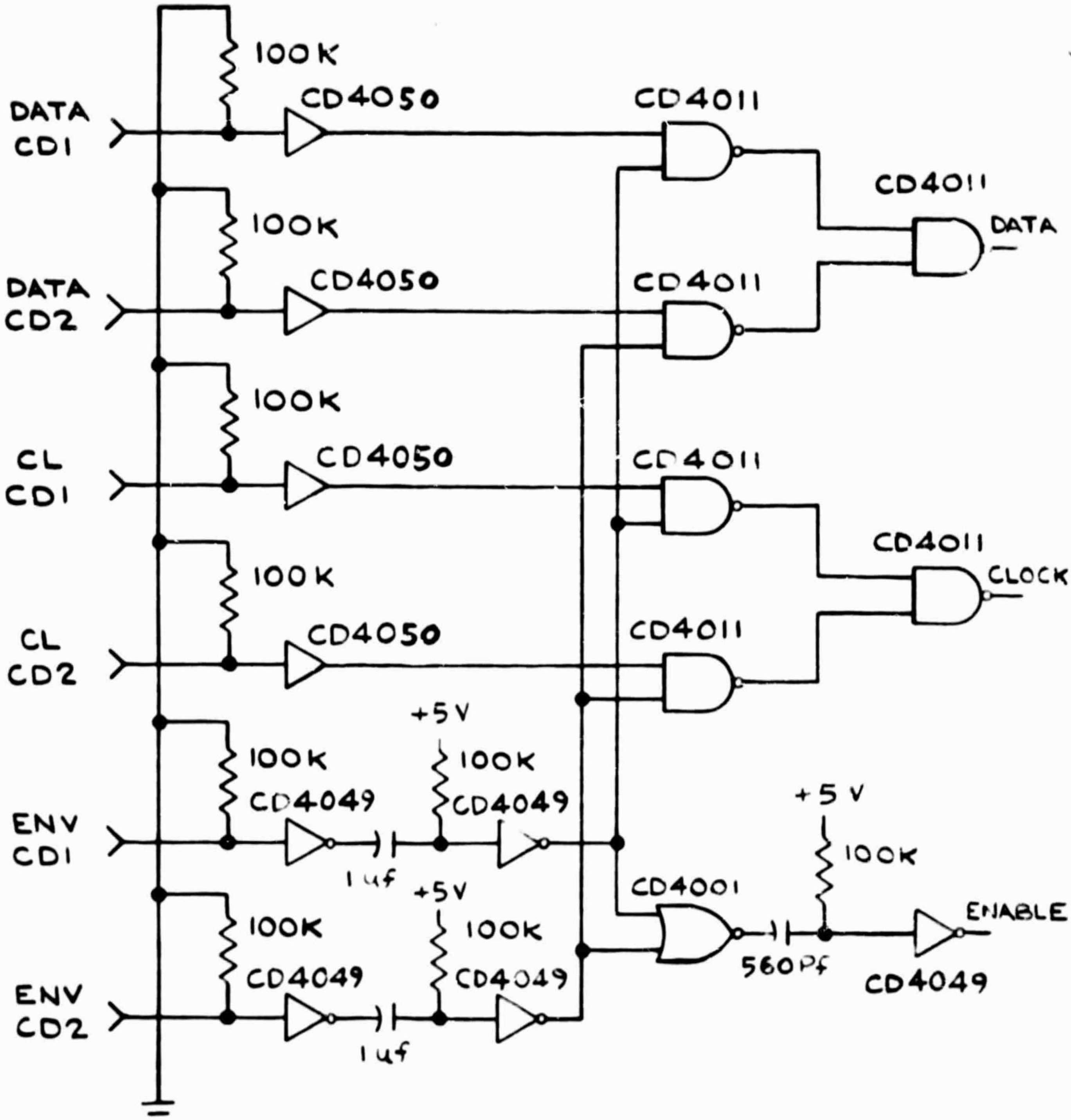
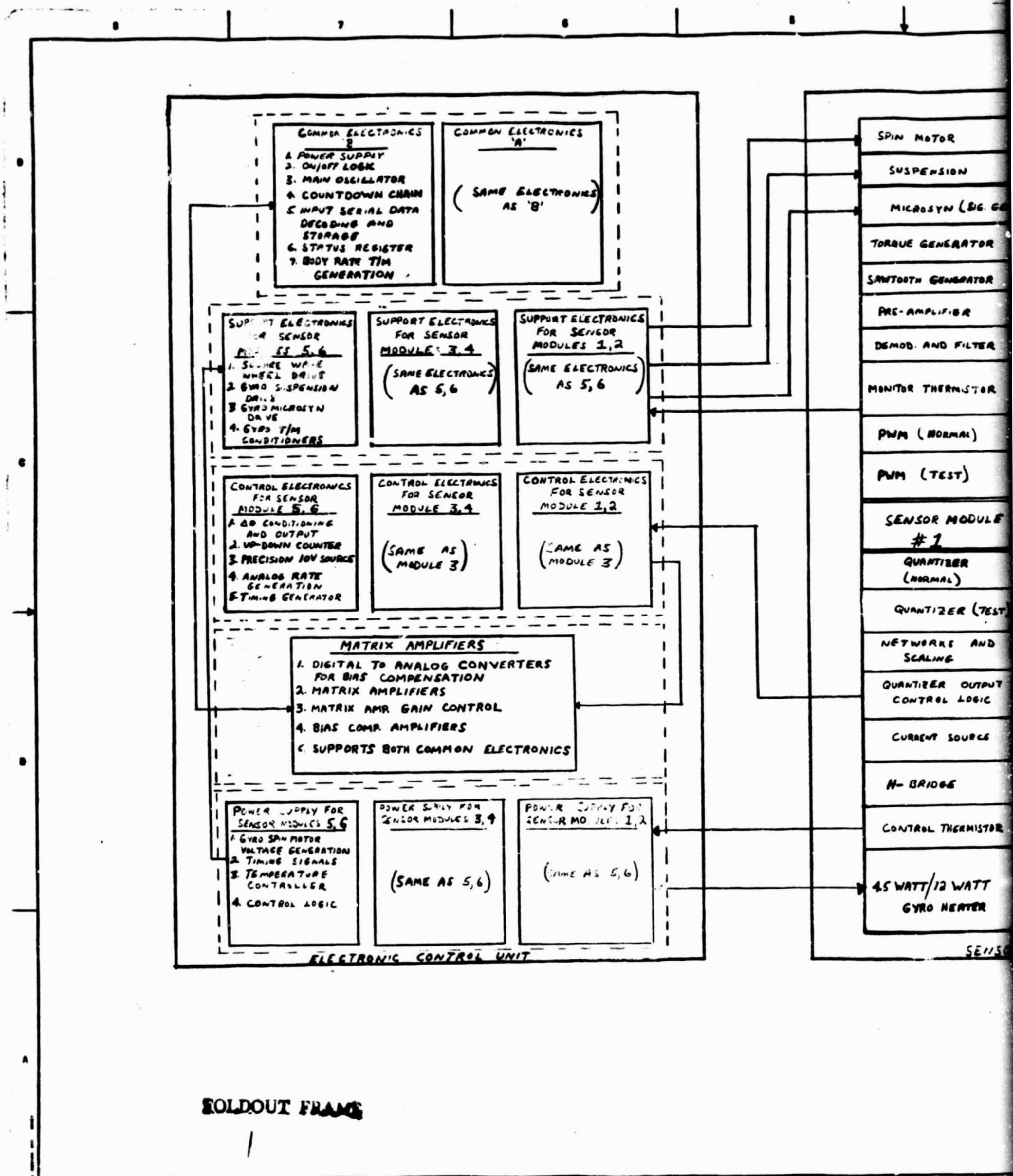


FIGURE 4-1

COMMAND DECODER
RECEIVER CIRCUIT



FOLDOUT FRAME

1

MF	REVISIONS				
	ZONE	LTR	DESCRIPTION	DATE	APPROVED

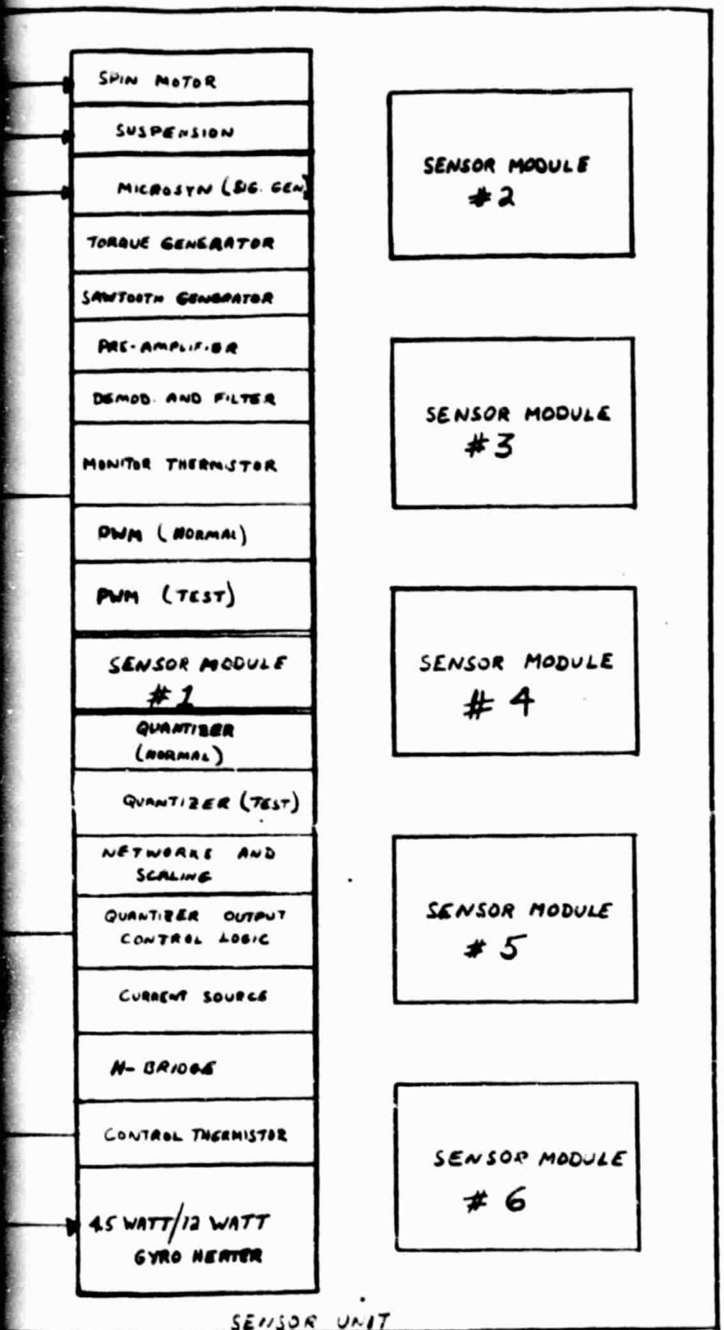


FIGURE 4-2

DR / CHK / ENGR / T.D. / MFT / REL / APPD	THE BENDIX CORPORATION — NAVIGATION & CONTROL DIVISION, TETERBORO, NEW JERSEY, U.S.A.
CONTRACT NO	IUE/IRA FUNCTIONAL PARTITIONING DIAGRAM
APPROVAL	SIZE: D — CODE IDENT NO.: 19315
APPROVAL	SCALE — SHEET

FOLDOUT FRAME 2

4.3 Rate Sensor and Supporting Electronics

The IRA contains six rate sensors. A minimum of three is required to support the mission. The common electronics can address any rate sensor in any sequence. Each rate sensor heater has two ranges and can operate both open loop and closed loop.

Each rate sensor has a redundant, buffered digital $\Delta\theta$ output. One is designated for transmission to DMU 'A', one to DMU 'B'. The output circuitry allows the DMU to address any gyro in any sequence. A failed gyro output or DMU address will not inhibit function of the redundant items.

4.4 Common Electronics/Rate Sensor Support Electronics Interface

The remaining area to be addressed is the interface between the common electronics and the rate sensor support electronics. All logic level interfaces are "OR" type interfaces. All voltage excitation interfaces have diode protection that will prevent a shorted line from inhibiting use of the other common electronics. A failed high line is corrected by switching the associated rate sensor or common electronics to off. No single point failure exists in the interface between the common electronics and the rate sensors.

5.0 RELIABILITY ANALYSIS

5.1 Reliability Prediction Results

The results of the preliminary reliability prediction, of the Inertial Reference Assembly (IRA) for the Internationl Ultraviolet Explorer (IUE) are presented below:

Probability of Survival (P_s) All Parts	Mission Time (t)
$P_{s_1}' = 0.9652$	$t_1 = 26,280$ hr*
$P_{s_2}' = 0.8579$	$t_2 = 43,800$ hr**

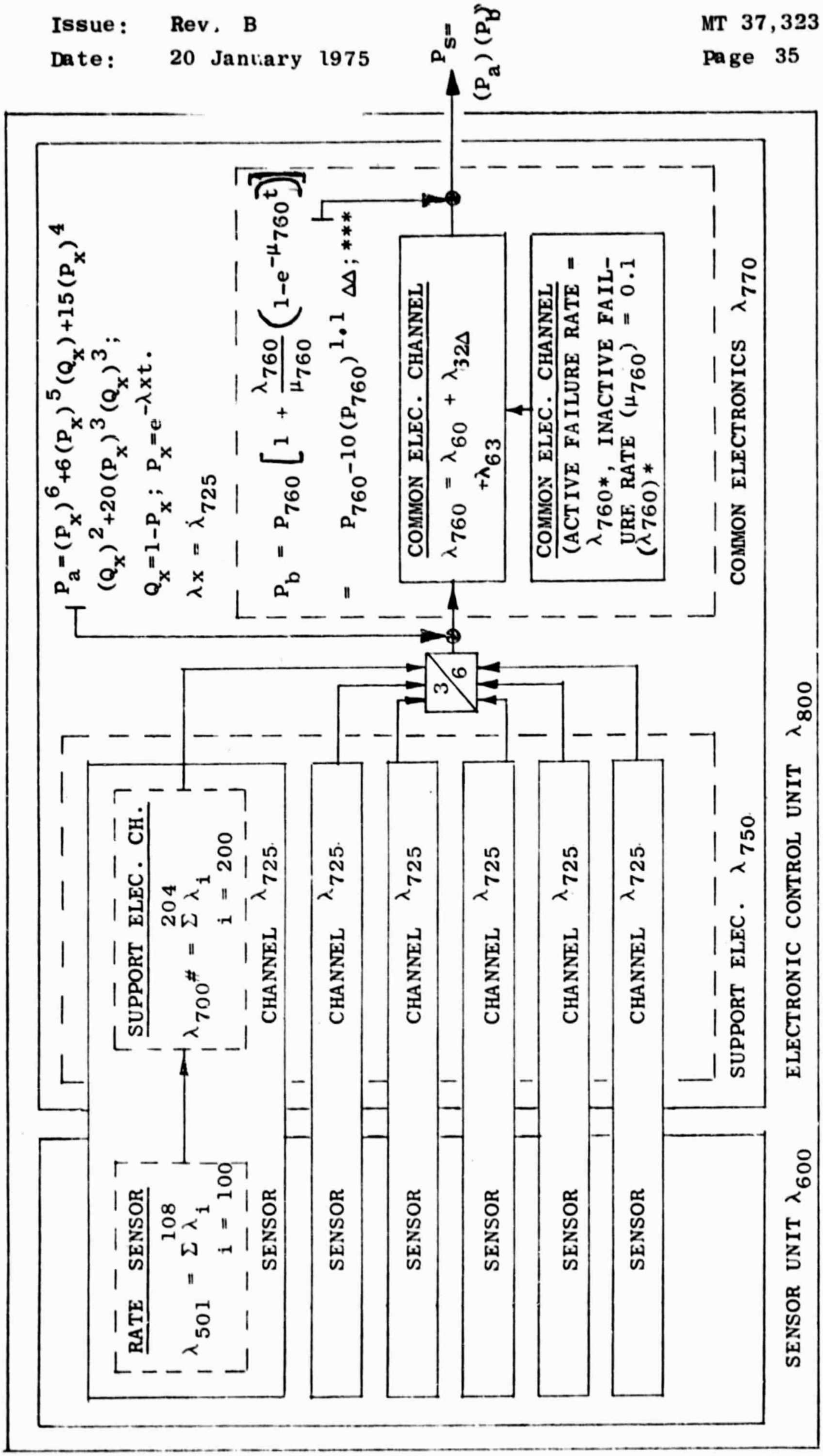
*Three years

**Five years

The IRA probabilities of survival tabulated above are based upon an orbital environment and an ambient temperature of 120°F (48.9°C), except for the Gyros which will be controlled to 135°F (57.2°C).

5.2 Reliability Block Diagram and Mathematical Model

The reliability block diagram and the associated mathematical model are depicted in Figure 5-1. Details of the analysis may be found in the DRL Reliability Report (GSD/RM 75-18, January 17, 1975).



INERTIAL REFERENCE ASSEMBLY λ_{900}

RELIABILITY BLOCK DIAGRAM AND MATHEMATICAL MODEL

FIGURE 5-1

6.0 PERFORMANCE SUMMARY

Table 6-1 is a summary of performance characteristics of the IRA system and the GSFC specification values. The table is self-explanatory. The IRA capabilities meet or exceed the specification values in all areas.

7.0 WEIGHT SUMMARY

The IRA weight breakdown is shown in Table 7-1. The total system weight is 48.35 pounds.

Issue: Rev. B

Date: 20 January 1975

TABLE 6-1

IRA PERFORMANCE CAPABILITY SUMMARY

PARA.NO.	PARAMETER	SPEC. VALUE	IRA CAPABILI
3.3.1	Integrated Rate Output	-	-
3.3.1.1	Pulse Weight	0.01 - 0.1 sec/pulse (Hold/Slew)	0.01 sec/pulse (H 0.30 sec/pulse (R
3.3.1.2	Range	± 600 sec/sec (Hold/Slew	± 672 sec/sec
3.3.1.3	Bandwidth	Gyro Time Constant <0.005 sec Loop Bandwidth >5 Hz	0.0011 sec 7.5 Hz
3.3.1.4	Scale Factor Linearity	± 0.1%	± 0.05%
3.3.1.5	Scale Factor Stability	± 0.01% over 35 days (min.)	± 0.01%
3.3.1.6a	Non g-Sensitive Bias Drift	± 5.0 sec/sec (max.)	± 3.0 sec/sec (ma
	Variation of Non g-Sensitive Drift Over Test	0.5 sec/sec	0.25 sec/sec
3.3.1.6b	g-Sensitive Drift	± 10.0 sec/sec/g (max)	± 0.75 sec/sec/g
	Variation of g-Sensitive Drift over Test	1.0 sec/sec/g	± 0.15 sec/sec/g
3.3.1.7	Bias Drift Stability	± 0.01 sec/sec over 35 days (min.)	± 0.01 sec/sec
3.3.1.8	Short-Term Attitude Noise	1 sec over 1st 5 min. 2 sec over 30 min	< 1 sec < 2 sec
	Variation on Consecutive Date Points	0.2 sec	0.1 sec
3.3.2	Analog Rate Output	-	-
3.3.2.1	Range	Linear over -5 to +5VDC	Same as spec value
	Scale Factor	Rate Mode (VDC/deg/sec) / Hold/Slew Mode (VDC/sec/sec) Pitch/Yaw 1.0 / 0.050 Roll 1.0 / 0.050	Same as spec value
3.3.2.2	Bias Compensation (Hold/Slew Mode)	± — sec/sec with resolution of 0.05 sec/sec and 0.60 sec/sec for roll	± 25 sec/sec (X12 0.05 sec/sec 0.60 sec/sec f

FOLDOUT FRAME

TABLE 6-1

RFORMANCE CAPABILITY SUMMARY

LUE	IRA CAPABILITY	BASIS FOR ESTIMATE
	-	-
c/pulse)	0.01 sec/pulse (Hold/Slew) 0.30 sec/pulse (Rate)	Design Analysis and 64 PM RIG Rate Sensor experience
	± 672' sec/sec	Design analysis
stant	0.0011 sec	Design analysis
h >5 Hz	7.5 Hz	
	± 0.05%	64 PM RIG Rate Sensor experience
35 days	± 0.01%	Design analysis and 64 PM RIG Rate Sensor experience
(max.)	± 3.0 sec/sec (max.)	64 PM RIG Rate Sensor experience
	0.25 sec/sec	64 PM RIG Rate Sensor experience
c/g (max)	± 0.75 sec/sec/g	64 PM RIG experience
	± 0.15 sec/sec/g	64 PM RIG experience
c over .)	± 0.01 sec/sec	64 PM RIG Rate Sensor experience
t 5 min.	< 1 sec	64 PM RIG Rate Sensor experience
min	< 2 sec	64 PM RIG Rate Sensor experience
	0.1 sec	64 PM RIG Rate Sensor experience
	-	-
-5 to +5VDC	Same as spec values	Design Analysis
Hold/Slew Mode (VDC/sec/sec) 0.050 0.050	Same as spec values	Design Analysis
with reso- 05 sec/sec /sec for roll	± 25 sec/sec (X12 in Roll) 0.05 sec/sec and 0.60 sec/sec for roll	Design Analysis

TABLE 7-1

IUE/IRA WEIGHT SUMMARY

Item	Weight (lbs.)
Sensor Unit	
Mechanical Structure	4.30
Optical Cube and Alignment Bar	0.15
Mount	1.60
ITEM	
Sensor Unit	
Rate Sensors	
Six Gyros @ 1.70 lb each	10.20
Six PRL Elect., Covers and Cables @ 1.43 each	8.6
Sensor Unit Total =	26.15
Electronic Control Unit	
Mechanical Structure	4.10 +
Connectors	0.44
EMI Modules	2.00
Electronics (12 Cards)	9.96
Back Panel Wiring	1.00
Miscellaneous Hardware	0.80
Electronic Control Unit Total =	22.2
System Total =	48.35

8.0 POWER SUMMARY

8.1 Detailed Power Breakdown

Table 8-1 describes the detailed power breakdown within the IRA. The nominal operating power required for the system is 74.2 watts. This figure includes six rate sensors on, one common electronics on and the gyro heaters drawing an average of 2.22 watts each.

It should be noted that the actual total power consumed by the IRA is dependent upon the temperature of the rate sensors, the number of rate sensor energized and the mode of the rate sensor heater (hi or lo).

TABLE 8.1

DETAILED POWER BREAKDOWN

ITEM	POWER (WATTS)	
RATE SENSOR		
GYRO TORQUER	0.150	
GYRO WHEEL	3.200	
GYRO SUSPENSION	0.185	
GYRO MICROSYN	0.002	
PRE-AMP	0.120	
DEMODULATOR	0.100	
GAIN CHANGE	0.010	
SAWTOOTH AND QUANT.	0.270	
TORQUER CURR. SOURCE	0.800	
TORQUER H-BRIDGE	0.550	
	5.387	SUBTOTAL - ONE RATE SENSOR
		x 6 = 32.328
SUPPORT ELECTRONICS		
WHEEL DRIVE	0.680	
SYNC DETECTOR	0.010	
TEMP. MON.	0.025	
MOTOR CURR. MON.	0.010	
MICROSYN DRIVE	0.150	
SUSPENSION DRIVE	0.480	
FILTER	0.050	
	1.405	SUBTOTAL - ONE CHANNEL
		x 6 = 8.430
CONTROL ELECTRONICS		
VOLTAGE REF.	0.45	
PWM TO DC CONV.	0.050	
INVERTER	0.050	
T/M CIRCUITS	0.010	
LOGIC	0.010	
	0.570	SUBTOTAL - ONE CHANNEL
		x 6 = 3.42

FOLDOUT FRAME

ABLE 8.1

D POWER BREAKDOWN

OR

ITEM	POWER (WATTS)	
GYRO PWR SUPPLY		
DC POWER SUPPLY	1.280	
TEMP. CONTROLLER	0.200	
	1.480	SUBTOTAL - ONE CHANNEL
		x 6 = 8.880
MATRIX AMPLIFIER		
LOGIC D/A CONVERTER AMPL	1.54	
COMMON ELECTRONICS		
T/M FUNCTIONS	0.030	
LOGIC	0.200	
OSCILLATOR	0.100	
POWER SUPPLY	0.230	
	0.560	
RFI FILTERS (6)	1.660	
HEATER CONTROL CKT (6)	4.068	
NOM. HEATER PWR (6)	13.32	

SYSTEM OPERATING POWER = 74.2 WATTS

(6 GYROS ON, TEMP STABILIZED)

FOLDOUT FRAME

2

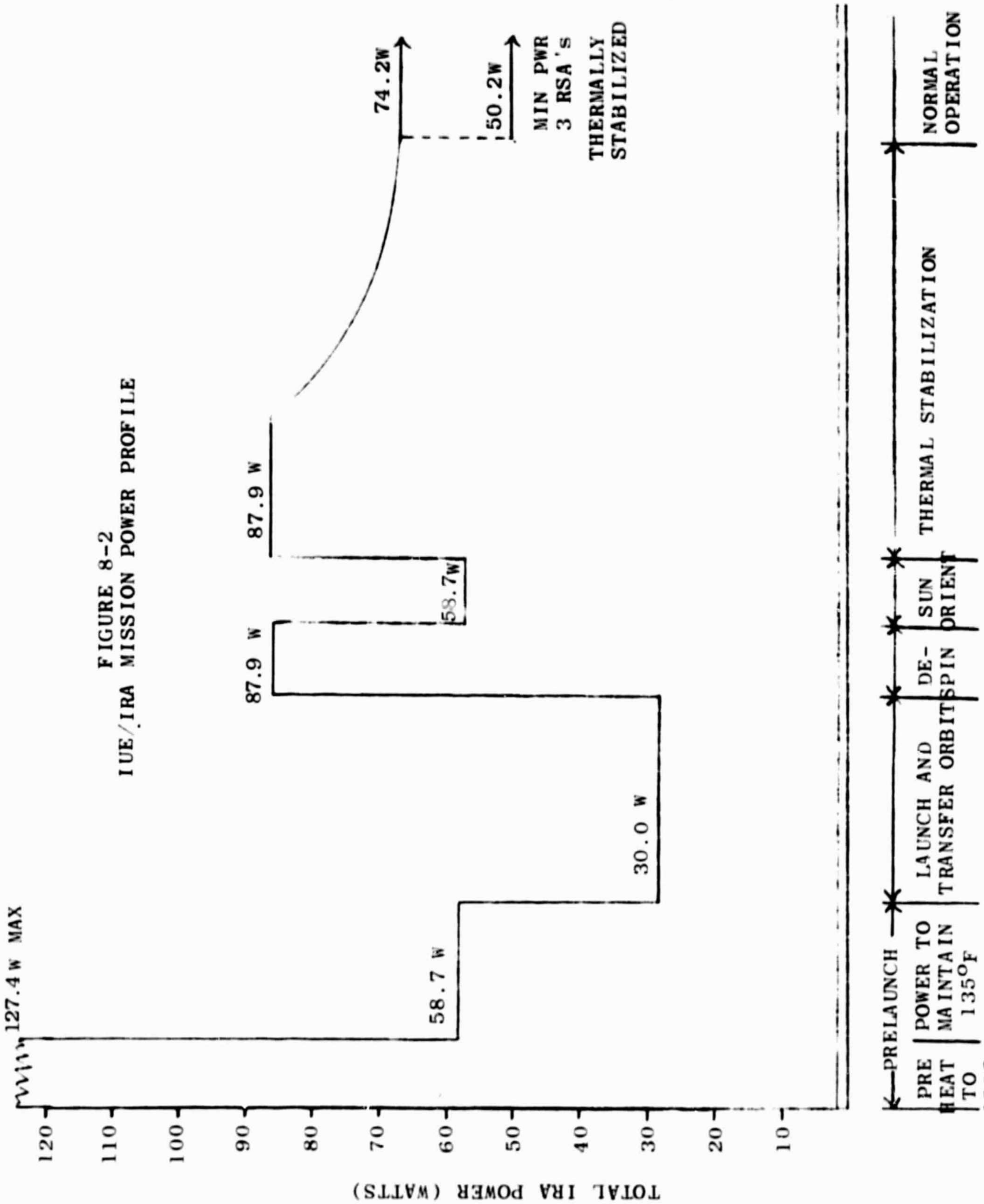


FIGURE 8-2
IUE/IRA MISSION POWER PROFILE

Breakdown of the total power numbers is as follows:

127.4 watt maximum - includes 72 watts heater power, 32 watts dissipation in 6 RSAs, 28 watts ECU power - represents the total power consumed if system is full on in the highest heater mode (used to obtain 135°F quickly during ground operation).

58.7 watts - heater power required to maintain 135°F on RSAs at 70°F ambient.

30.0 watts - maximum power available to the IRA during launch and transfer orbit.

87.9 watts - total power consumed with heaters in the 4.5 watt state, ECU and six RSAs 'on' and all RSAs below 135°F.

58.3 watts - total power consumed with heaters in the 4.5 watt state (all six 'on'), 1/2 ECU 'on' and three RSAs 'on'.

74.2 watts - steady state power consumption with six RSAs 'on'

50.2 watts - steady state power consumption with three RSAs 'on'.

9.0 MECHANICAL CONFIGURATION SUMMARY

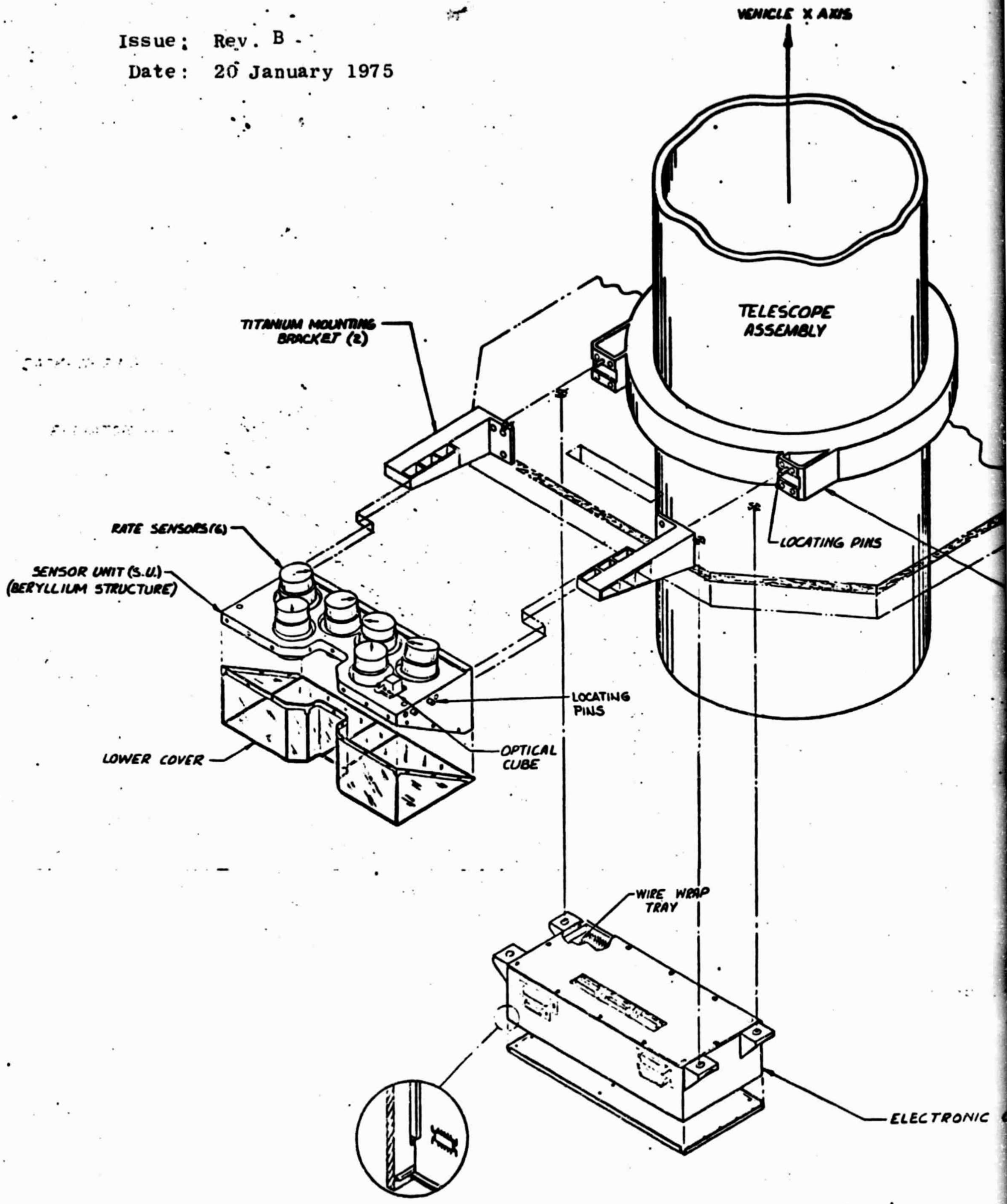
Figure 9-1 shows an exploded view of the IRA units illustrating the mounting arrangement to the telescope strong ring and honeycomb structure. The Sensor Unit mounts to the strong ring in a cantilever manner. A titanium mounting strut is used for strength and proper thermal characteristics. The lower cover of the Sensor Unit is an aluminum frame with aluminized mylar skin.

The cutout in the Sensor Unit is for passage of the six rate sensor cables to the Electronic Control Unit below. Each sensor cable is identical in pin assignment but contains different keying. By changing the keying each rate sensor will be interchangeable with the others.

Mounted below the Sensor Unit is the Electronic Control Unit. This unit contains six connectors for interface with the SU, three connectors for the S/C interface and one test connector.

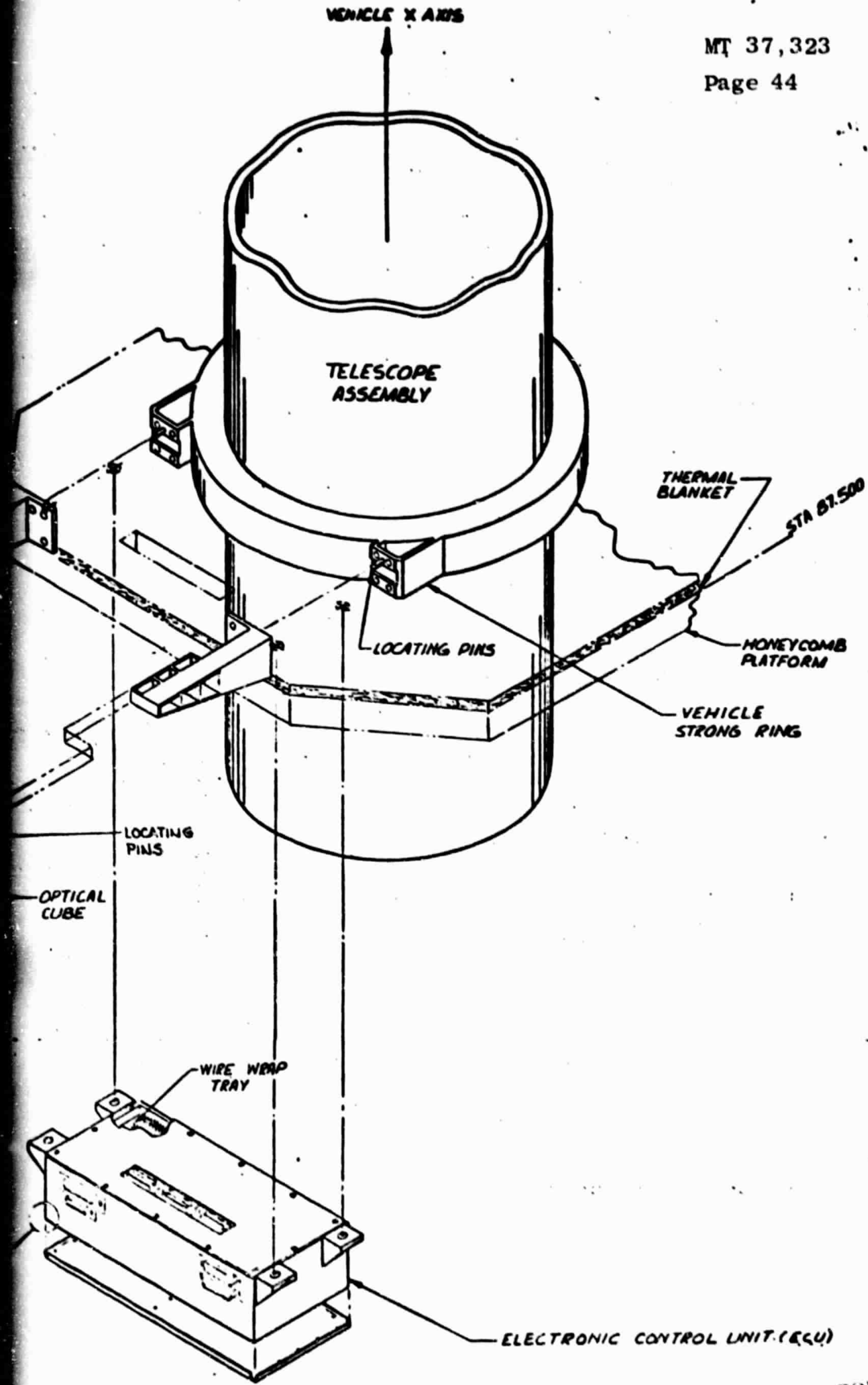
Issue: Rev. B

Date: 20 January 1975



IUE/IRA EXP

FOLDOUT FRAME



FOLDOUT FRAME 2

IUE/IRA EXPLODED VIEW

10.0 MECHANICAL INTERFACE

10.1 Sensor Package Mechanical Interface

Figure 10-1 defines the mechanical interface between the IUE/IRA Sensor Package and the IUE Strong Ring.

Eight (8) .250 bolts are used for mounting in the $.261 {}^{+.006}_{-.001}$ clearance holes.

Two (2) $.2501 {}^{+.0000}_{-.0001}$ diameter locating pins will be used for location of the IRA Sensor Package. The pins used will be fabricated of 416 Corrosion Resistant Steel, and will have a lead-in angle for ease of installation. A 416 CRE pin with a .2500 diameter will sustain a shear load of 3600 pounds. Assuming no frictional force due to the tightening of the eight (8) mounting bolts, the worst case shear load at each pin would be 1600 pounds.

Detail dimensions and tolerances of the recommended pin are shown in Figure 10-3.

Since GSD has been advised by GSFC that the Strong Ring has been manufactured and contains the keyway as shown in Figure 10-1, the locating pin will be located in the thicker section of the Strong Ring rather than the geometric center of the mounting holes.

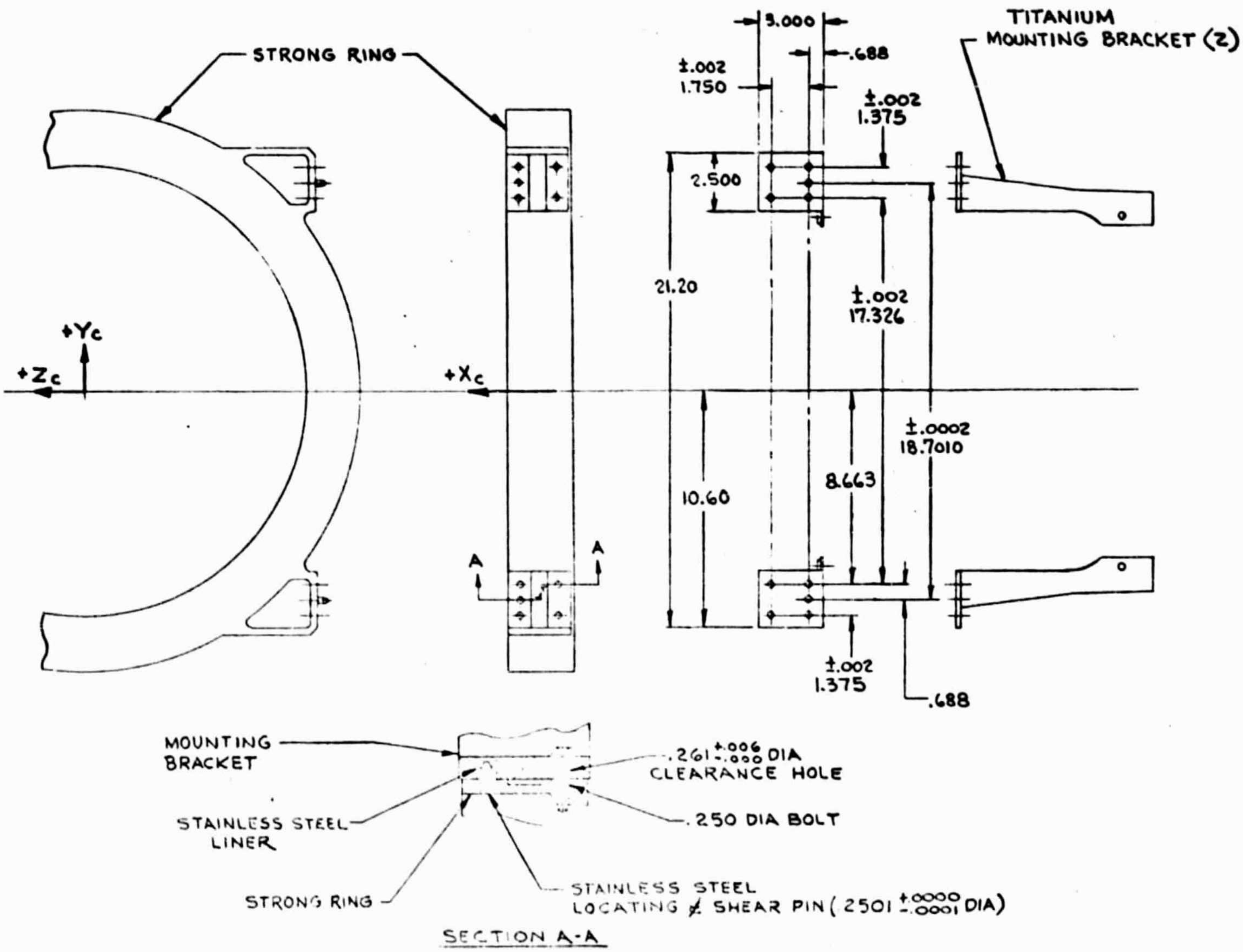


FIGURE 10-1

IUE/IRA MECHANICAL INTERFACE
(SENSOR PACKAGE)

10.1 (continued)

A recommended transfer tool for locating the holes in the IUE Strong Ring is shown in Figure 10-2. The transfer tool would be matched to the holes in the mounting ring and aligned to it within $\pm$ .0002 inches. Removable hardened steel bushings would be used for first drilling the holes in the Strong Ring and a second set for reaming to final size prior to installing the locating pins. Final hole size should be $.2504 \begin{smallmatrix} + .0002 \\ - .0000 \end{smallmatrix}$ in the IRA to provide a fit of .0003 to .0006 loose; and $.2496 \begin{smallmatrix} + .0002 \\ - .0000 \end{smallmatrix}$ to provide a fit of .0002 to .0005 tight in the strong ring.

The IRA Sensor Package mounts by the use of .250 bolts through clearance holes (.261 dia.) rather than tapped holes. This implies the use of washers, lockwashers and nuts on the other side of the Strong Ring (Ref. Figure 1).

Receipt of GSFC Drawing GE1172537 and conversations with GSFC has indicated that no mounting problem exists.

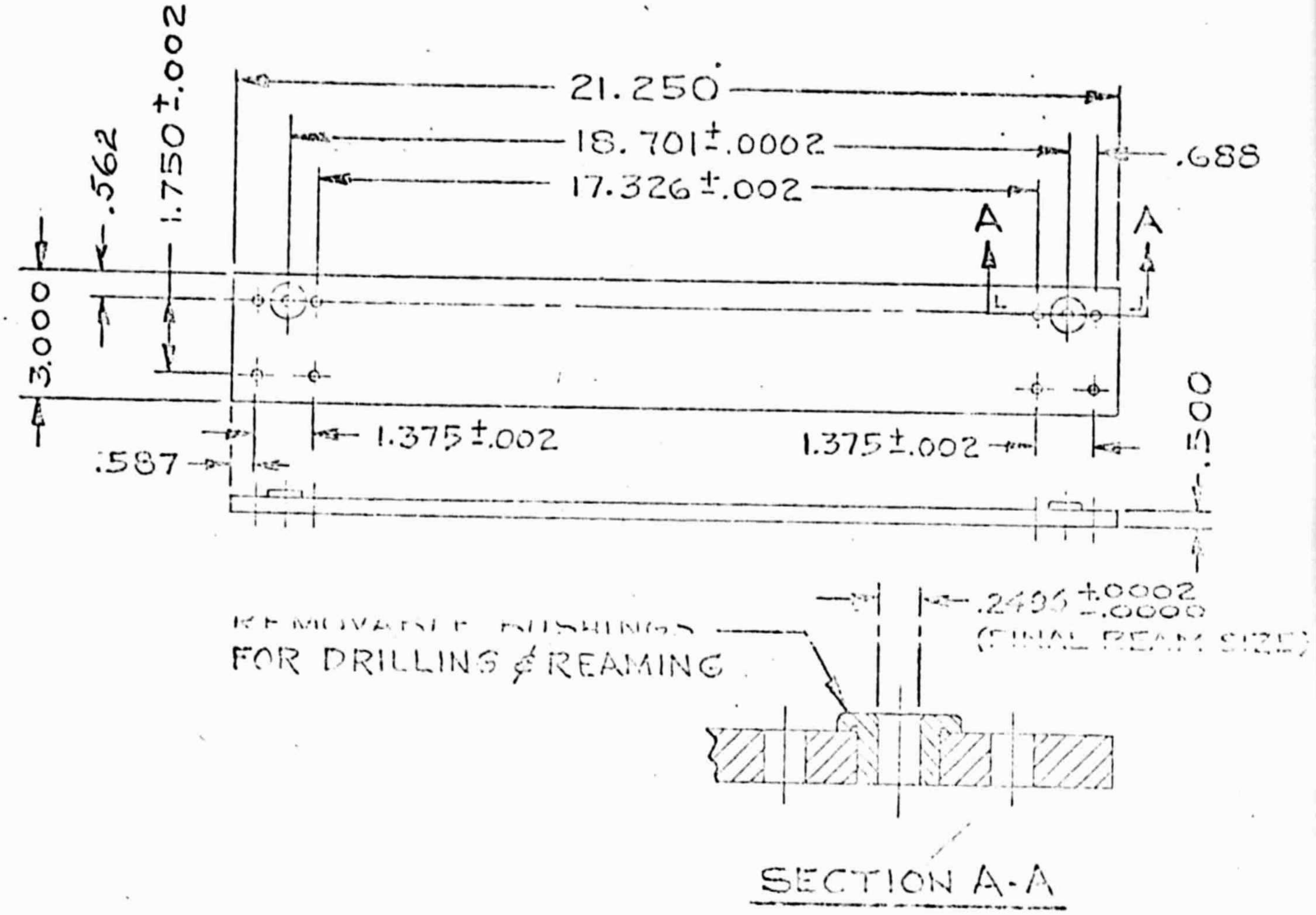
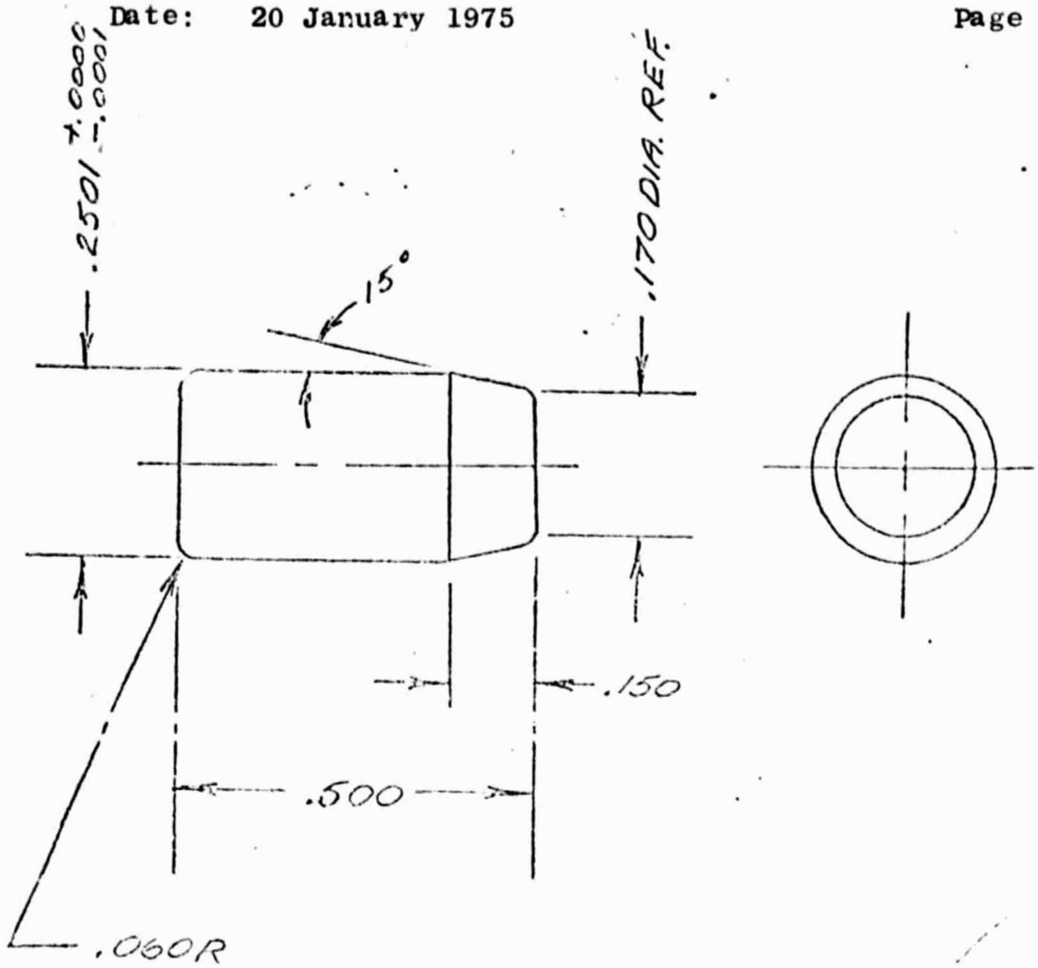


FIGURE 10-2
TRANSFER TOOL CONCEPT



MTL. - CRE PAR-416
QQ-S-763
Rc 34-38

FIGURE 10-3
LOCATING PIN

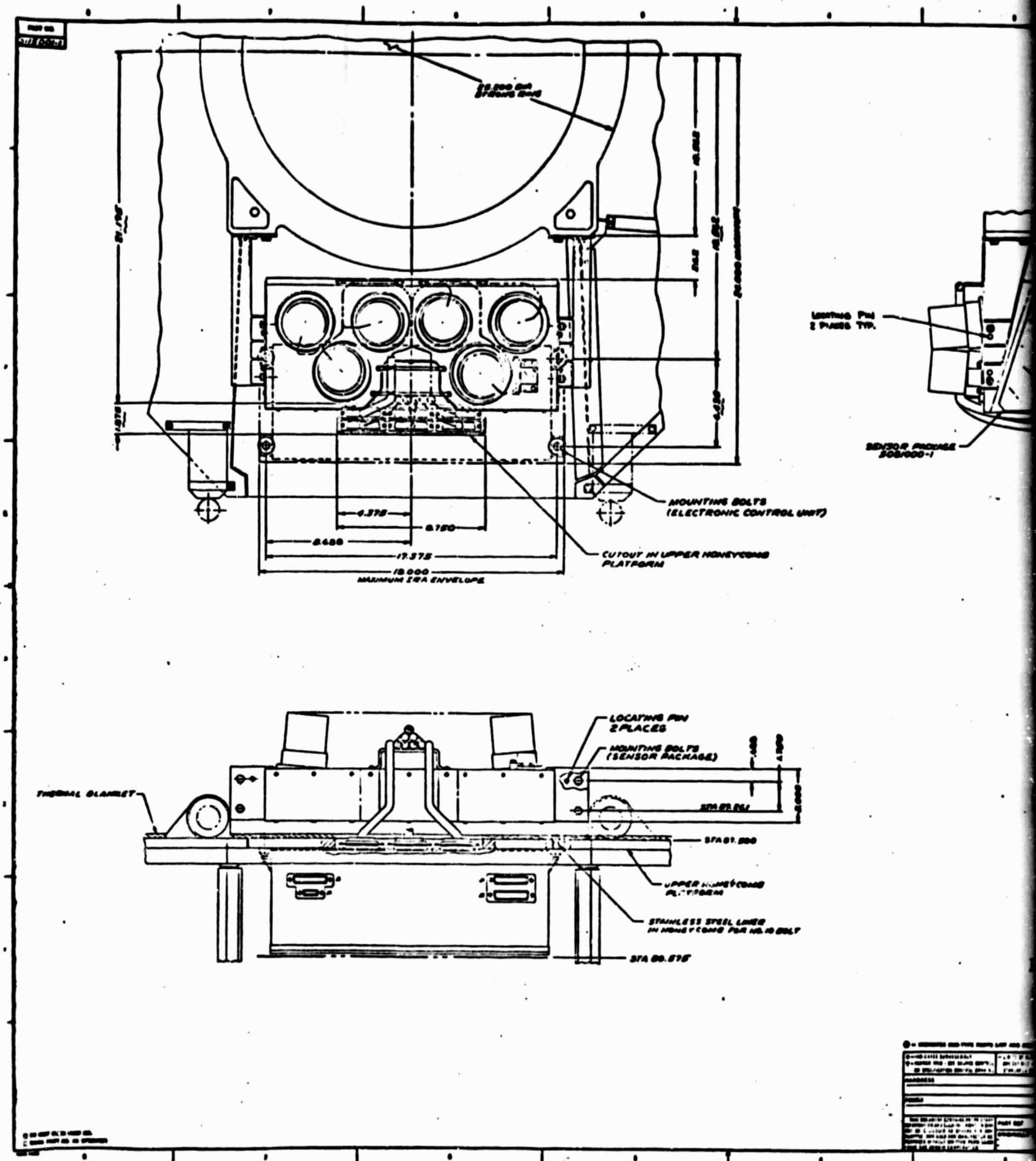
10.2 Electronic Control Unit Mechanical Interface

Figure 10-4 illustrates the mechanical interface and interconnect for the Sensor Unit and the Electronic Control Unit. This figure shows the mounting dimensions with respect to the Strong Ring Interface; the Sensor Unit above the upper honeycomb platform and the Electronics Unit mounted below. Each Rate Sensor mounted in the sensor unit is connected to the electronics unit directly by means of a cable originating at each individual rate sensor and terminating at the electronics control unit connector interface. A separate ECU connector is used for each rate sensor.

11.0 ELECTRICAL INTERFACE

11.1 Functional Interface

Figure 11-1 shows the basic electrical interface of the IRA boxes with each other and with the spacecraft. The spacecraft interface is two 78 pin connectors and one 26 pin connector. All power is on the 26 pin connector.



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1

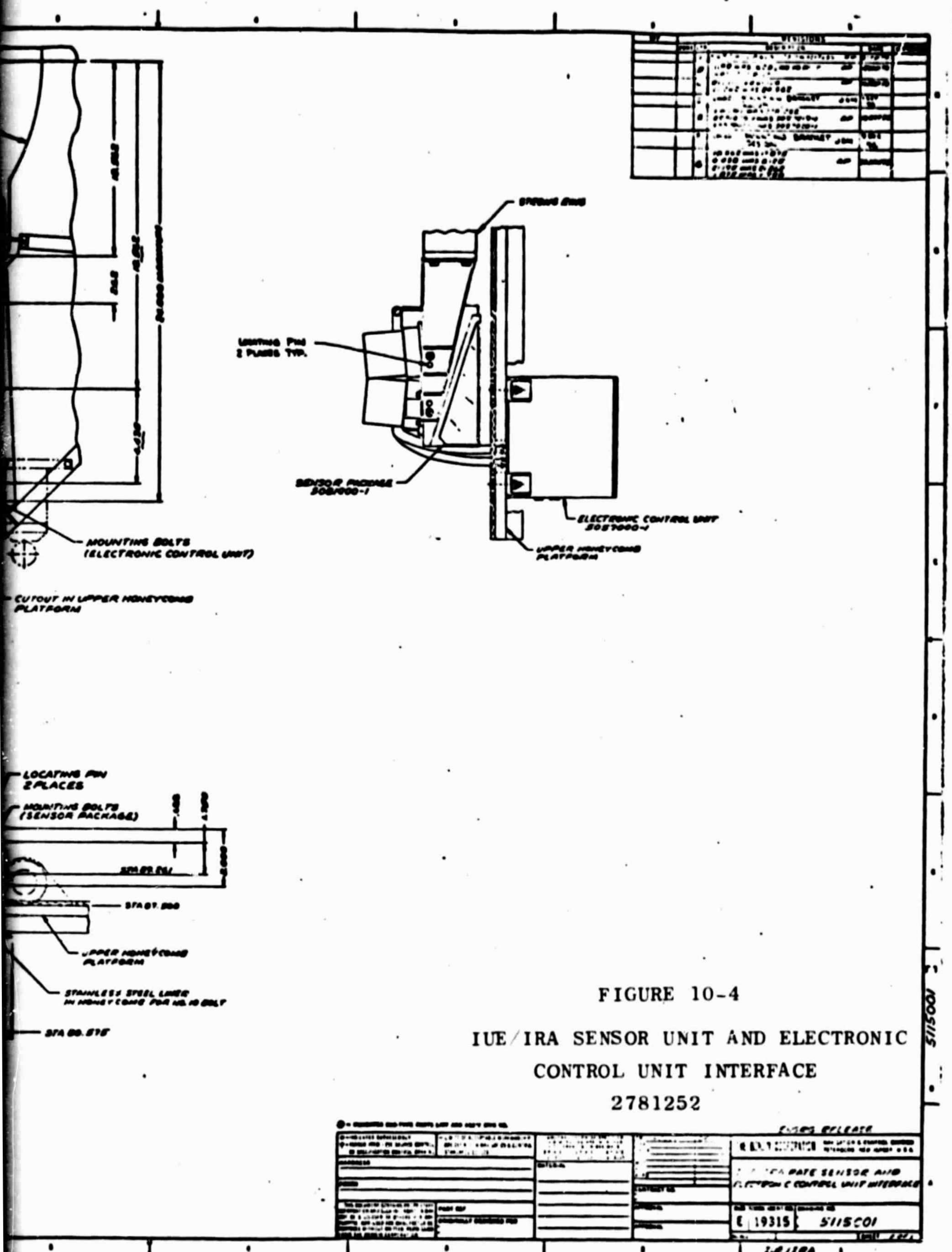


FIGURE 10-4

IUE/IRA SENSOR UNIT AND ELECTRONIC CONTROL UNIT INTERFACE

2781252

FOLDOUT FRAME

2

The interface between the SU and ECU is by six 50 pin connectors, one for each rate sensor.

Also contained on the ECU is a 104 pin connector used strictly for test purposes. This connector will be capped for flight.

Figure 11-2 shows the IRA pin function diagram. The two 78 pin connectors were made to be functionally identical as were the six 50 pin rate sensor connectors.

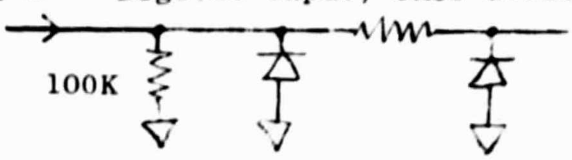
11.2 Detailed Electrical Interface

The IRA/Spacecraft electrical interface can be characterized by several input and output circuit types. These types are shown below. Table 11-1 details the electrical characteristics of each signal with reference to the circuit type.

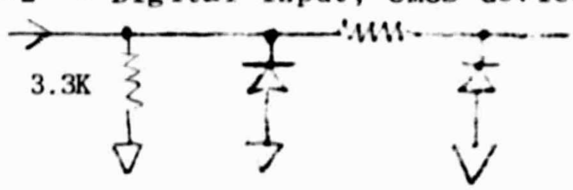
Type: B 1-6 - Power buss input, 28 VDC ± 2%, complex load (R = 62.2 Ω)

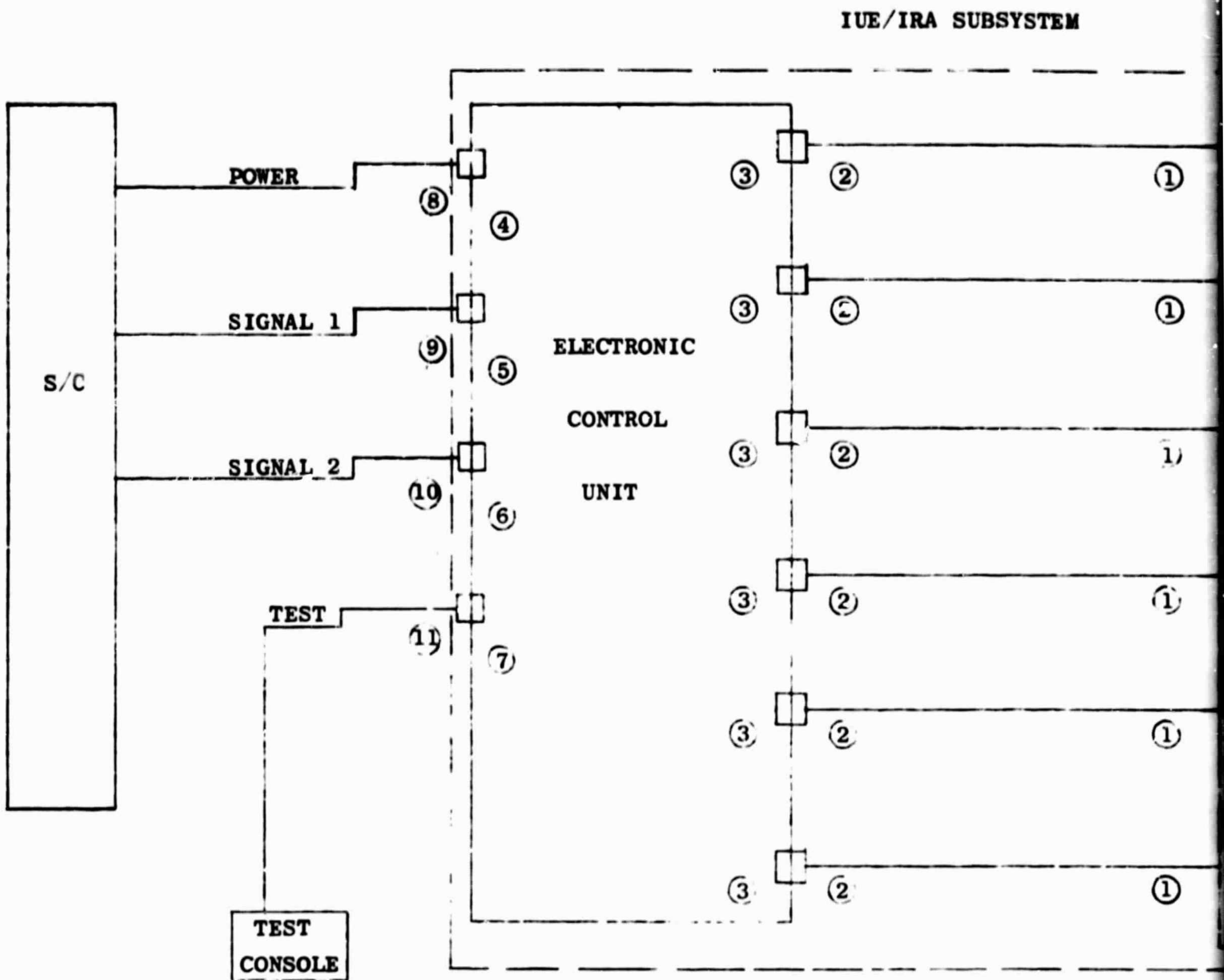
B 7-8 - Power buss input, 28 VDC ± 2%, complex load (R = 509 Ω)

DI-1 - Digital input, CMOS device 4050, 4049



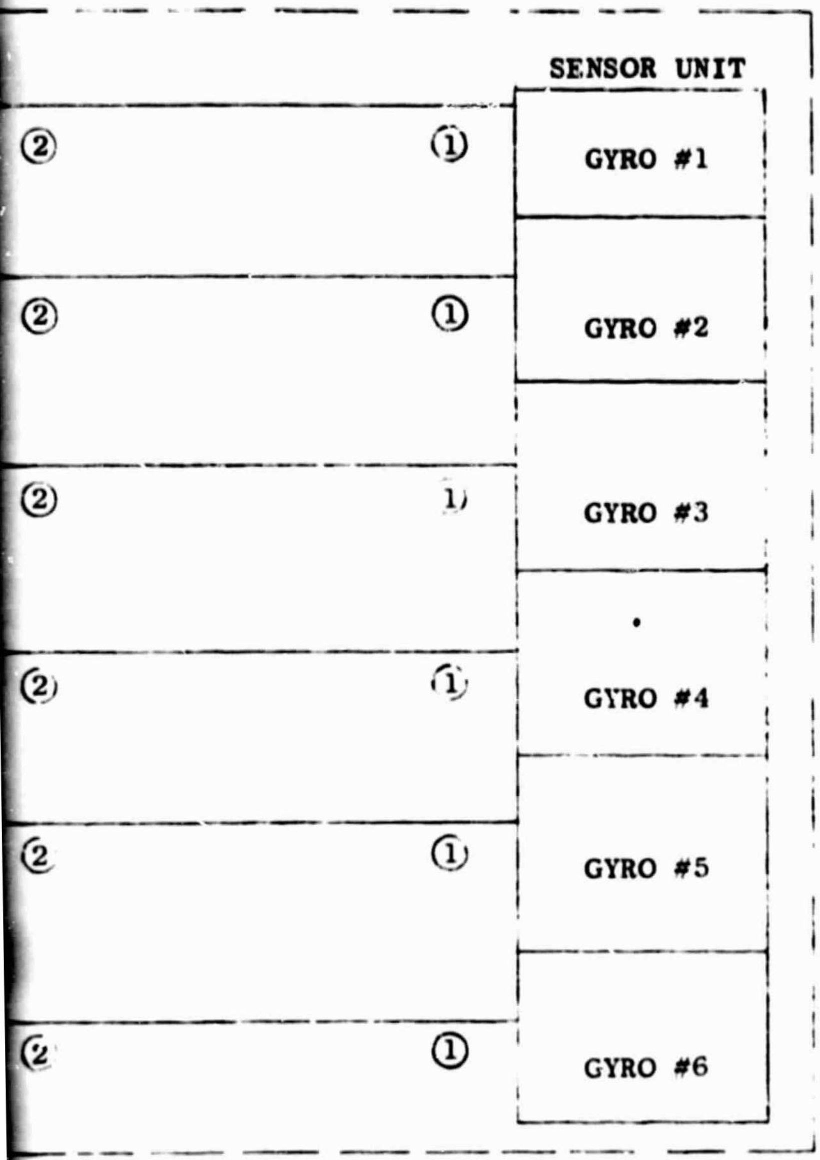
DI-2 - Digital input, CMOS device 4050, 4049




IUE/IRA SUBSYSTEM
POWER
SIGNAL 1
SIGNAL 2
TEST
S/C
ELECTRONIC
CONTROL
UNIT
TEST
CONSOLE
8
4
9
5
10
6
11
7
3
2
1

FOLDOUT FRA

IUE/IRA SUBSYSTEM



1. CONNECTIONS MADE INTERNAL TO GYRO MODULE
2. CANNON DDMAM50P (MIL M 24308/3-5) ALL KEYED DIFFERENTLY
3. CANNON DDMAM50S (MIL M24308/2-5) ALL KEYED W.R.T. 2
4. 311 P 407-2P-B-15
5. 311 P 407-5S-B-15
6. 311 P 407-5S-B-15 WITH DIFFERENT KEY FROM 5
7. 311 P 407-6S-B-15
8. 311 P 407-2S-B-15
9. 311 P 407-5P-B-15
10. 311 P 407-5P-B-15 WITH DIFFERENT KEY FROM 9
11. 311 P 407-6P-B-15

FIGURE 11-1 IUE/IRA FUNCTIONAL INTERFACE

FIGURE 11-1

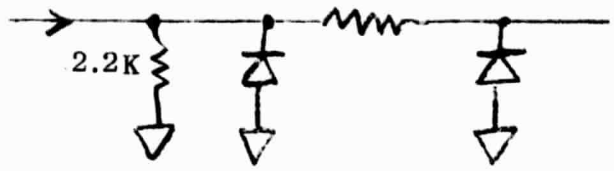
FOLDOUT FRAME

2

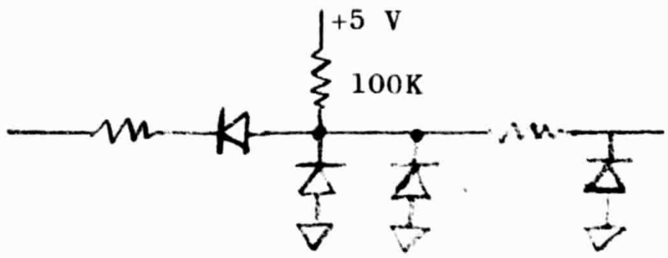
Bendix GUIDANCE SYSTEMS DIVISION

11.2 (continued)

DI-3 - Digital input, CMOS device 4050, 4049



DI-4 - Digital input (test connector)



DO-1 - Digital output, CMOS driver device 4050, 4049, 1K resistor in series with output, can drive one T^2L load

AO-1 - Analog output, $\pm$ 10 VDC range, drive current = [illegible]2 ma, source impedance 1K ohms

AO-2 - Analog telemetry output, + 5.6 VDC to - 0.7 VDC range, source impedance 4.99 K ohms.

FOLDOUT FRAME

POWER

1	+28 VDC BUSS #1 HI
2	+28 VDC BUSS #1 HI
3	+28 VDC BUSS #2 HI
4	+28 VDC BUSS #2 HI
5	+28 VDC BUSS #3 HI
6	+28 VDC BUSS #3 HI
7	+28 VDC BUSS #4 HI
8	+28 VDC BUSS #4 HI
9	+28 VDC BUSS #5 HI
10	+28 VDC BUSS #5 HI
11	+28 VDC BUSS #6 HI
12	+28 VDC BUSS #6 HI
13	+28 VDC BUSS #7 HI
14	+28 VDC BUSS #7 HI
15	+28 VDC BUSS #8 HI
16	+28 VDC BUSS #8 HI
17	DC POWER GROUND
18	DC POWER GROUND
19	DC POWER GROUND
20	DC POWER GROUND
21	SPARE
22	SPARE
23	SPARE
24	SPARE
25	SPARE
26	SHIELD

SIGNAL #1

1	SPARE
2	SPARE
3	SPARE
4	SPARE
5	DATA WORD, COMMON 'A', CD 'A'
6	ENVELOPE, COMMON 'A', CD 'A'
7	SHIFT, COMMON 'A', CD 'A'
8	DATA WORD, COMMON 'B', CD 'A'
9	ENVELOPE, COMMON 'B', CD 'A'
10	SHIFT, COMMON 'B', CD 'A'
11	GYRO #1 Δθ, DMU 'A'
12	GYRO #2 Δθ, DMU 'A'
13	GYRO #3 Δθ, DMU 'A'
14	GYRO #4 Δθ, DMU 'A'
15	GYRO #5 Δθ, DMU 'A'
16	GYRO #6 Δθ, DMU 'A'
17	GYRO #1 ENVELOPE, DMU 'A'
18	GYRO #2 ENVELOPE, DMU 'A'
19	GYRO #3 ENVELOPE, DMU 'A'
20	GYRO #4 ENVELOPE, DMU 'A'
21	GYRO #5 ENVELOPE, DMU 'A'
22	GYRO #6 ENVELOPE, DMU 'A'
23	GYRO #1 SHIFT, DMU 'A'
24	GYRO #2 SHIFT, DMU 'A'
25	GYRO #3 SHIFT, DMU 'A'
26	GYRO #4 SHIFT, DMU 'A'
27	GYRO #5 SHIFT, DMU 'A'
28	GYRO #6 SHIFT, DMU 'A'
29	DMU 'A' INTERROGATE
30	DMU 'A' INTERROGATE
31	STATUS WORD, COM. 'A', DMU 'A'
32	WORD GATE, COM. 'A', DMU 'A'
33	SHIFT, COM. 'A', DMU 'A'
34	STATUS WORD, COM. 'B', DMU 'A'
35	WORD GATE, COM. 'B', DMU 'A'
36	SHIFT, COM. 'B', DMU 'A'
37	LOGIC GROUND
38	LOGIC GROUND
39	BODY RATE, COM. 'A' ω_{xc} HI
40	BODY RATE, COM. 'A' ω_{yc} HI
41	BODY RATE, COM. 'A' ω_{xc} HI
42	BODY RATE, COM 'A' ω_{x_c}, RETURN
43	BODY RATE, COM. 'A' ω_{zc} HI, DMU 'A', T/M
44	BODY RATE, COM. 'A' ω_{yc} HI, DMU 'A', T/M
45	BODY RATE, COM. 'A' ω_{xc} HI, DMU 'A', T/M

46	GYRO #1 TEMP, DMU 'A'	T/M
47	GYRO #3 TEMP, DMU 'A'	T/M
48	GYRO #5 TEMP, DMU 'A'	T/M
49	ECU TEMP #1, DMU 'A'	T/M
50	SPARE	
51	GYRO #1 ϕ_B MOTOR CURRENT, DMU 'A',	T/M
52	GYRO #3 ϕ_B MOTOR CURRENT, DMU 'A'	T/M
53	GYRO #5 ϕ_B MOTOR CURRENT, DMU 'A',	T/M
54	ANALOG GROUND	
55	ANALOG GROUND	
56	GYRO #1 RATE HI, DMU 'A',	T/M
57	GYRO #3 RATE HI, DMU 'A',	T/M
58	GYRO #5 RATE HI, DMU 'A',	T/M
59	BODY RATE, COM 'A' ω_{Z_C}, RETURN	
60	BODY RATE, COM 'A' ω_{Z_C}, RETURN	
61	BODY RATE, COM. 'B' ω_{xc} HI, DMU 'A'	T/M
62	GYRO #2 TEMP, DMU 'A'	T/M
63	GYRO #4 TEMP, DMU 'A'	T/M
64	GYRO #6 TEMP, DMU 'A'	T/M
65	GYRO #2 ϕB MOTOR CURRENT, DMU 'A'	T/M
66	GYRO #4 ϕB MOTOR CURRENT, DMU 'A'	T/M
67	GYRO #6 ϕB MOTOR CURRENT, DMU 'A'	T/M
68	GYRO #2 RATE HI, DMU 'A'	T/M
69	GYRO #4 RATE HI, DMU 'A'	T/M
70	GYRO #6 RATE HI, DMU 'A'	T/M
71	BODY RATE, COM 'B' ω_{Y_C}, HI, DMU 'A'	T/M
72	BODY RATE, COM 'B' ω_{Z_C}, HI, DMU 'A'	T/M
73	SPARE	
74	SPARE	
75	SPARE	
76	SPARE	
77	SPARE	
78	SHIELD	

SI

1	SPARE
2	SPARE
3	SPARE
4	SPARE
5	DATA WORD, C
6	ENVELOPE, CO
7	SHIFT, COMMO
8	DATA WORD, C
9	ENVELOPE, CO
10	SHIFT, COMMO
11	GYRO #1 Δθ,
12	GYRO #2 Δθ,
13	GYRO #3 Δθ,
14	GYRO #4 Δθ,
15	GYRO #5 Δθ,
16	GYRO #6 Δθ,
17	GYRO #1 ENVE
18	GYRO #2 ENVE
19	GYRO #3 ENVE
20	GYRO #4 ENVE
21	GYRO #5 ENVE
22	GYRO #6 ENVE
23	GYRO #1 SHIF
24	GYRO #2 SHIF
25	GYRO #3 SHIF
26	GYRO #4 SHIF
27	GYRO #5 SHIF
28	GYRO #6 SHIF
29	DMU 'B' INTE
30	DMU 'B' INTE
31	STATUS WORD,
32	WORD GATE, C
33	SHIFT, COM.
34	STATUS WORD,
35	WORD GATE, C
36	SHIFT, COM.
37	LOGIC GROUND
38	LOGIC GROUND
39	BODY RATE, C
40	BODY RATE, C
41	BODY RATE, C
42	BODY RATE, C
43	BODY RATE,
44	BODY RATE, C
45	BODY RATE, C

ORIGINAL PAGE IS OF POOR QUALITY

J4

J1

IUE/IRA ELECT

J5 J7 J8

P5

1	BUFFERED RATE HI
2	NOT WIRED
3	NOT WIRED
4	+10 VDC
5	-10 VDC
6	NOT WIRED
7	NOT WIRED
8	RESET QUANTIZER
9	START DUTY CYCLE LIMIT SIGNAL *
10	DUTY CYCLE LIMIT SIGNAL
11	CLOCK FREQ. 153.6 KHZ
12	SUSPENSION CURRENT TG
13	SUSPENSION CURRENT SG
14	HEATER NO. 1 HI 4.5W WINDING
15	HEATER NO. 1 LO 4.5W WINDING
16	HEATER NO. 2 HI 7.5W WINDING
17	HEATER NO. 2 LO 7.5W WINDING
18	SIM TORQUING SIGNAL
19	SUSP-TP
20	WIRED SPARE
21	ANALOG GND
22	+15 VDC
23	WIRED SPARE
24	WIRED SPARE

P7

1	BUFFERED RATE HI
2	NOT WIRED
3	NOT WIRED
4	+10 VDC
5	- VDC
6	NOT WIRED
7	NOT WIRED
8	RESET QUANTIZER
9	START DUTY CYCLE LIMIT SIGNAL *
10	DUTY CYCLE LIMIT SIGNAL
11	CLOCK FREQ. 153.6 KHZ
12	SUSPENSION CURRENT TG
13	SUSPENSION CURRENT SG
14	HEATER NO. 1 HI 4.5W WINDING
15	HEATER NO. 1 LO 4.5W WINDING
16	HEATER NO. 2 HI 7.5W WINDING
17	HEATER NO. 2 LO 7.5W WINDING
18	SIM TORQUING SIGNAL
19	SUSP TP
20	WIRED SPARE
21	ANALOG GND
22	+15 VDC
23	WIRED SPARE
24	WIRED SPARE

P8

1	BUFFERED RATE HI
2	NOT WIRED
3	NOT WIRED
4	+10 VDC
5	-10 VDC
6	NOT WIRED
7	NOT WIRED
8	RESET QUANTIZER
9	START DUTY CYCLE LIMIT SIGNAL *
10	DUTY CYCLE LIMIT SIGNAL
11	CLOCK FREQ. 153.6 KHZ
12	SUSPENSION CURRENT TG
13	SUSPENSION CURRENT SG
14	HEATER NO. 1 HI 7.5W WINDING
15	HEATER NO. 1 LO 4.5W WINDING
16	HEATER NO. 2 HI 7.5W WINDING
17	HEATER NO. 2 LO 7.5W WINDING
18	SIM TORQUING SIGNAL
19	SUSP-TP
20	WIRED SPARE
21	ANALOG GND
22	+15 VDC
23	WIRED SPARE
24	WIRED SPARE

1	BUFFERE
2	NOT WIR
3	NOT WIR
4	+10 VDC
5	-10 VDC
6	NOT WIR
7	NOT WIR
8	RESET QU
9	START D
10	DUTY CYC
11	CLOCK F
12	SUSPENSI
13	SUSPENSI
14	HEATER
15	HEATER
16	HEATER
17	HEATER
18	SIM TORQ
19	SUSP-
20	WIRED S
21	ANALOG
22	+15 VDC
23	WIRED S
24	WIRED

SIGNAL #2

RE
RE
RE
RE
TA WORD, COMMON 'A', CD 'B'
ELOPE, COMMON 'A', CD 'B'
FT, COMMON 'A', CD 'B'
TA WORD, COMMON 'B', CD 'B'
ELOPE, COMMON 'B', CD 'B'
FT, COMMON 'B', CD 'B'
O #1 Δθ, DMU 'B'
O #2 Δθ, DMU 'B'
O #3 Δθ, DMU 'B'
O #4 Δθ, DMU 'B'
O #5 Δθ, DMU 'B'
O #6 Δθ, DMU 'B'
O #1 ENVELOPE, DMU 'B'
O #2 ENVELOPE, DMU 'B'
O #3 ENVELOPE, DMU 'B'
O #4 ENVELOPE, DMU 'B'
O #5 ENVELOPE, DMU 'B'
O #6 ENVELOPE, DMU 'B'
O #1 SHIFT, DMU 'B'
O #2 SHIFT, DMU 'B'
O #3 SHIFT, DMU 'B'
O #4 SHIFT, DMU 'B'
O #5 SHIFT, DMU 'B'
O #6 SHIFT, DMU 'B'
'B' INTERROGATE
'B' INTERROGATE
TUS WORD, COM. 'A', DMU 'B'
D GATE, COM. 'A', DMU 'B'
FT, COM. 'A', DMU 'B'
TUS WORD, COM. 'B', DMU 'B'
D GATE, COM. 'B', DMU 'B'
FT, COM. 'B', DMU 'B'
IC GROUND
IC GROUND
Y RATE, COM. 'B' ω xc HI
Y RATE, COM. 'B' ω yc HI
Y RATE, COM. 'B' ω xc HI
Y RATE, COM 'B' ωX_C, RETURN
Y RATE, COM. 'A' ω xc HI, DMU 'B' T/M
Y RATE, COM. 'A' ω yc HI, DMU 'B' T/M
Y RATE, COM. 'A' ω xc HI, DMU 'B' T/M

46	GYRO #1 TEMP, DMU 'B' T/M
47	GYRO #3 TEMP, DMU 'B' T/M
48	GYRO #5 TEMP, DMU 'B' T/M
49	ECU TEMP #1, DMU 'B' T/M
50	SPARE
51	GYRO #1 ΦB MOTOR CURRENT, DMU 'B' T/M
52	GYRO #3 ΦB MOTOR CURRENT, DMU 'B' T/M
53	GYRO #5 ΦB MOTOR CURRENT, DMU 'B' T/M
54	ANALOG GROUND
55	ANALOG GROUND
56	GYRO #1 RATE HI, DMU 'B' T/M
57	GYRO #3 RATE HI, DMU 'B' T/M
58	GYRO #6 RATE HI, DMU 'B' T/M
59	BODY RATE, COM 'B' ωZ_C, RETURN
60	BODY RATE, COM 'B' ωY_C, RETURN
61	BODY RATE, COM. 'B' ω xc HI, DMU 'B', T/M
62	GYRO #2 TEMP, DMU 'B' T/M
63	GYRO #4 TEMP, DMU 'B' T/M
64	GYRO #6 TEMP, DMU 'B' T/M
65	GYRO #2ΦB MOTOR CURRENT, DMU 'B', T/M
66	GYRO #4ΦB MOTOR CURRENT, DMU 'B', T/M
67	GYRO #6ΦB MOTOR CURRENT, DMU 'B', T/M
68	GYRO #2 RATE HI, DMU 'B', T/M
69	GYRO #4 RATE HI, DMU 'B', T/M
70	GYRO #6 RATE HI, DMU 'B', T/M
71	BODY RATE, COM 'B' ωY_C, HI, DMU B T/M
72	BODY RATE, COM 'B' ωZ_C, HI, DMU B T/M
73	SPARE
74	SPARE
75	SPARE
76	SPARE
77	SPARE
78	SHIELD

TEST

1	+15 VDC, GYRO #1
2	+10 VDC, GYRO #1
3	-10 VDC, GYRO #1
4	+ 5 VDC, GYRO #1
5	+15 VDC, GYRO #2
6	+10 VDC, GYRO #2
7	-10 VDC, GYRO #2
8	+ 5 VDC, GYRO #2
9	+15 VDC, GYRO #3
10	+10 VDC, GYRO #3
11	-10 VDC, GYRO #3
12	+ 5 VDC, GYRO #3
13	+15 VDC, GYRO #4
14	+10 VDC, GYRO #4
15	-10 VDC, GYRO #4
16	+ 5 VDC, GYRO #4
17	+15 VDC GYRO #5
18	+10 VDC, GYRO #5
19	-10 VDC, GYRO #5
20	+ 5 VDC, GYRO #5
21	+15 VDC, GYRO #6
22	+10 VDC, GYRO #6
23	-10 VDC, GYRO #6
24	+ 5 VDC, GYRO #6
25	SPARE
26	SIM. TORQ. SIG. GYRO #1
27	SIM. TORQ. SIG. GYRO #2
28	SIM. TORQ. SIG. GYRO #3
29	SIM. TORQ. SIG. GYRO #4
30	SIM. TORQ. SIG. GYRO #5
31	SIM. TORQ. SIG. GYRO #6
32	MICROSYN EXC. GYRO #1 HI
33	MICROSYN EXC. GYRO #2 HI
34	MICROSYN EXC. GYRO #3 HI
35	MICROSYN EXC. GYRO #4 HI
36	MICROSYN EXC. GYRO #5 HI
37	MICROSYN EXC. GYRO #6 HI
38	SIM TQ EN TEST 1,3,5
39	SIM TQ EN TEST 2,4,6
40	WHL EN TEST 1,3,5
41	WHL EN TEST 2,4,6
42	SPARE
43	SPARE
44	GYRO #1 HTR DUTY CYCLE HI
45	GYRO #2 HTR DUTY CYCLE HI
46	GYRO #3 HTR DUTY CYCLE HI
47	GYRO #4 HTR DUTY CYCLE HI
48	GYRO #5 HTR DUTY CYCLE HI
49	GYRO #6 HTR DUTY CYCLE HI
50	HTR DUTY CYCLE GND
51	SUS CNT 1,3,5
52	SUS CNT 2,4,6
53	SPARE
54	SPARE
55	SPARE
56	GYRO #1 WHEEL VOLTS ΦA HI

57	GYRO #1 WHEEL VOLTS ΦA LO
58	GYRO #2 WHEEL VOLTS ΦA HI
59	GYRO #2 WHEEL VOLTS ΦA LO
60	GYRO #3 WHEEL VOLTS ΦA HI
61	GYRO #3 WHEEL VOLTS ΦA LO
62	GYRO #4 WHEEL VOLTS ΦA HI
63	GYRO #4 WHEEL VOLTS ΦA LO
64	GYRO #5 WHEEL VOLTS ΦA HI
65	GYRO #5 WHEEL VOLTS ΦA LO
66	GYRO #6 WHEEL VOLTS ΦA HI
67	GYRO #6 WHEEL VOLTS ΦA LO
68	SPARE
69	SUSP. EXC. GYRO #1 HI
70	SUSP. EXC. GYRO #2 HI
71	SUSP. EXC. GYRO #3 HI
72	SUSP. EXC. GYRO #4 HI
73	SUSP. EXC. GYRO #5 HI
74	SUSP. EXC. GYRO #6 HI
75	SUSP. CURR. GYRO #1 TG LO
76	SUSP. CURR. GYRO #1 SG LO
77	SUSP. CURR. GYRO #2 TG LO
78	SUSP. CURR. GYRO #2 SG LO
79	SUSP. CURR. GYRO #3 TG LO
80	SUSP. CURR. GYRO #3 SG LO
81	SUSP. CURR. GYRO #4 TG LO
82	SUSP. CURR. GYRO #4 SG LO
83	SUSP. CURR. GYRO #5 TG LO
84	SUSP. CURR. GYRO #5 SG LO
85	SUSP. CURR. GYRO #6 TG LO
86	SUSP. CURR. GYRO #6 SG LO
87	BUFF. RATE, GYRO #1 HI
88	BUFF. RATE, GYRO #2 HI
89	BUFF. RATE, GYRO #3 HI
90	BUFF. RATE, GYRO #4 HI
91	BUFF. RATE, GYRO #5 HI
92	BUFF. RATE, GYRO #6 HI
93	307.2 KHz COM. 'A'
94	307.2 KHz COM. 'B'
95	DETO COM. 'A'
96	DETO COM. 'B'
97	GYRO #1 QUANTIZER OUTPUT
98	GYRO #2 QUANTIZER OUTPUT
99	GYRO #3 QUANTIZER OUTPUT
100	GYRO #4 QUANTIZER OUTPUT
101	GYRO #5 QUANTIZER OUTPUT
102	GYRO #6 QUANTIZER OUTPUT
103	SIGNAL GROUND
104	SHIELD

J3

J2

ECTRONIC CONTROL UNIT

J9 P9

J6 P6

J10 P10

BUFFERED RATE HI
NOT WIRED
NOT WIRED
+10 VDC
-10 VDC
NOT WIRED
NOT WIRED
RESET QUANTIZER
START DUTY CYCLE LIMIT SIGNAL *
DUTY CYCLE LIMIT SIGNAL
CLOCK FREQ. 153.6 KHZ
SUSPENSION CURRENT TG
SUSPENSION CURRENT SG
HEATER NO. 1 HI 4.5W WINDING
HEATER NO. 1 LO 4.5W WINDING
HEATER NO. 2 HI 7.5W WINDING
HEATER NO. 2 LO 7.5W WINDING
SIM TORQUING SIGNAL
SUSP-TP
WIRED SPARE
ANALOG GND
+15 VDC
WIRED SPARE
WIRED SPARE

1	BUFFERED RATE HI
2	NOT WIRED
3	NOT WIRED
4	+10 VDC
5	-10 VDC
6	NOT WIRED
7	NOT WIRED
8	RESET QUANTIZER
9	START DUTY CYCLE LIMIT SIGNAL *
10	DUTY CYCLE LIMIT SIGNAL
11	CLOCK FREQ. 153.6 KHZ
12	SUSPENSION CURRENT TG
13	SUSPENSION CURRENT SG
14	HEATER NO. 1 HI 4.5W WINDING
15	HEATER NO. 1 LO 4.5W WINDING
16	HEATER NO. 2 HI 7.5W WINDING
17	HEATER NO. 2 LO 7.5W WINDING
18	SIM TORQUING SIGNAL
19	SUSP-TP
20	WIRED SPARE
21	ANALOG GND
22	+15 VDC
23	WIRED SPARE
24	WIRED SPARE

1	BUFFERED RATE HI
2	NOT WIRED
3	NOT WIRED
4	+10 VDC
5	-10 VDC
6	NOT WIRED
7	NOT WIRED
8	RESET QUANTIZER
9	START DUTY CYCLE LIMIT SIGNAL *
10	DUTY CYCLE LIMIT SIGNAL
11	CLOCK FREQ. 153.6 KHZ
12	SUSPENSION CURRENT TG
13	SUSPENSION CURRENT SG
14	HEATER NO. 1 HI 4.5W WINDING
15	HEATER NO. 1 LO 4.5W WINDING
16	HEATER NO. 2 HI 7.5W WINDING
17	HEATER NO. 2 LO 7.5W WINDING
18	SIM TORQUING SIGNAL
19	SUSP-TP
20	WIRED SPARE
21	ANALOG GND
22	+15 VDC
23	WIRED SPARE
24	WIRED SPARE

REVISIONS

LTR	DESCRIPTION	DATE	APP
A	REVISED	6-27-73	RB
B	REVISED CRF 520753-1	6-11-76	[illegible]
C	CR-F523821 REFER J.L.	8-22-77	[illegible]

J5 | J7 | J8

	P5	P7	P8	
1	BUFFERED RATE HI	BUFFERED RATE HI	BUFFERED RATE HI	BUFFERED RATE
2	NOT WIRED	NOT WIRED	NOT WIRED	NOT WIRED
3	NOT WIRED	NOT WIRED	NOT WIRED	NOT WIRED
4	+10 VDC	+10 VDC	+10 VDC	+10 VDC
5	-10 VDC	-10 VDC	-10 VDC	-10 VDC
6	NOT WIRED	NOT WIRED	NOT WIRED	NOT WIRED
7	NOT WIRED	NOT WIRED	NOT WIRED	NOT WIRED
8	RESET QUANTIZER	RESET QUANTIZER	RESET QUANTIZER	RESET QUANTIZE
9	START DUTY CYCLE LIMIT SIGNAL *	START DUTY CYCLE LIMIT SIGNAL *	START DUTY CYCLE LIMIT SIGNAL *	START DUTY CY
10	DUTY CYCLE LIMIT SIGNAL	DUTY CYCLE LIMIT SIGNAL	DUTY CYCLE LIMIT SIGNAL	DUTY CYCLE LI
11	CLOCK FREQ. 153.6 KHZ	CLOCK FREQ. 153.6 KHZ	CLOCK FREQ. 153.6 KHZ	CLOCK FREQ. 1
12	SUSPENSION CURRENT TG	SUSPENSION CURRENT TG	SUSPENSION CURRENT TG	SUSPENSION CU
13	SUSPENSION CURRENT SG	SUSPENSION CURRENT SG	SUSPENSION CURRENT SG	SUSPENSION CU
14	HEATER NO. 1 HI 4.5W WINDING	HEATER NO. 1 HI 4.5W WINDING	HEATER NO. 1 HI 4.5W WINDING	HEATER NO. 1
15	HEATER NO. 1 LO 4.5W WINDING	HEATER NO. 1 LO 4.5W WINDING	HEATER NO. 1 LO 4.5W WINDING	HEATER NO. 1
16	HEATER NO. 2 HI 7.5W WINDING	HEATER NO. 2 HI 7.5W WINDING	HEATER NO. 2 HI 7.5W WINDING	HEATER NO. 2
17	HEATER NO. 2 LO 7.5W WINDING	HEATER NO. 2 LO 7.5W WINDING	HEATER NO. 2 LO 7.5W WINDING	HEATER NO. 2
18	SIM TORQUING SIGNAL	SIM TORQUING SIGNAL	SIM TORQUING SIGNAL	SIM TORQUING
19	SUSP-TP	SUSP-TP	SUSP-TP	SUSP-TP
20	WIRED SPARE	WIRED SPARE	WIRED SPARE	WIRED SPARE
21	ANALOG GND	ANALOG GND	ANALOG GND	ANALOG GND
22	+15 VDC	+15 VDC	+15 VDC	+15 VDC
23	WIRED SPARE	WIRED SPARE	WIRED SPARE	WIRED SPARE
24	WIRED SPARE	WIRED SPARE	WIRED SPARE	WIRED SPARE
25	SIM TORQUING COMMAND	SIM TORQUING COMMAND	SIM TORQUING COMMAND	SIM TORQUING
26	BUFFERED QUANTIZER OUTPUT	BUFFERED QUANTIZER OUTPUT	BUFFERED QUANTIZER OUTPUT	BUFFERED QUAN
27	START SAWTOOTH	START SAWTOOTH	START SAWTOOTH	START SAWTOOTH
28	WIRED SPARE	WIRED SPARE	WIRED SPARE	WIRED SPARE
29	MICROSYN DRIVE LO	MICROSYN DRIVE LO	MICROSYN DRIVE LO	MICROSYN DRIV
30	CONTROL THERMISTOR	CONTROL THERMISTOR	CONTROL THERMISTOR	CONTROL THERM
31	WHEEL POWER φA LO	WHEEL POWER φA LO	WHEEL POWER φA LO	WHEEL POWER
32	WHEEL POWER φB LO	WHEEL POWER φB LO	WHEEL POWER φB LO	WHEEL POWER
33	SUSPENSION DRIVE LO	SUSPENSION DRIVE LO	SUSPENSION DRIVE LO	SUSPENSION DR
34	DEMOD REFERENCE	DEMOD REFERENCE	DEMOD REFERENCE	DEMOD REFEREN
35	MONITOR THERMISTOR	MONITOR THERMISTOR	MONITOR THERMISTOR	MONITOR THERM
36	MONITOR THERMISTOR	MONITOR THERMISTOR	MONITOR THERMISTOR	MONITOR THERM
37	WIRED SPARE	WIRED SPARE	WIRED SPARE	WIRED SPARE
38	LOGIC GND	LOGIC GND	LOGIC GND	LOGIC GND
39	+5 VDC	+5 VDC	+5 VDC	+5 VDC
40	WIRED SPARE	WIRED SPARE	WIRED SPARE	WIRED SPARE
41	SHIELD (OUTER)	SHIELD (OUTER)	SHIELD (OUTER)	SHIELD (OUT
42	GAIN CONTROL	GAIN CONTROL	GAIN CONTROL	GAIN CONTROL
43	MODE CONTROL	MODE CONTROL	MODE CONTROL	MODE CONTROL
44	WIRED SPARE	WIRED SPARE	WIRED SPARE	WIRED SPARE
45	MICROSYN DRIVE HI	MICROSYN DRIVE HI	MICROSYN DRIVE HI	MICROSYN DRIV
46	CONTROL THERMISTOR	CONTROL THERMISTOR	CONTROL THERMISTOR	CONTROL THERM
47	WHEEL POWER φA HI	WHEEL POWER φA HI	WHEEL POWER φA HI	WHEEL POWER
48	WHEEL POWER φB HI	WHEEL POWER φB HI	WHEEL POWER φB HI	WHEEL POWER
49	SUSPENSION DRIVE #1	SUSPENSION DRIVE #1	SUSPENSION DRIVE #1	SUSPENSION
50	SHIELD (INNER)	SHIELD (INNER)	SHIELD (INNER)	SHIELD (INN

GYRO #1 | GYRO #2 | GYRO #3 | GYRO

IUE/IRA SENSOR UNIT

FOLDOUT FRAME 3

ONIC CONTROL UNIT

J3 J2

J9 / P9

TE HI
IZER
CYCLE LIMIT SIGNAL *
LIMIT SIGNAL
153.6 KHZ
CURRENT TG
CURRENT SG
1 HI 4.5W WINDING
1 LO 4.5W WINDING
2 HI 7.5W WINDING
2 LO 7.5W WINDING
G SIGNAL
L COMMAND
ANTIZER OUTPUT
OTH
IVE LO
MISTOR
ΦA LO
ΦB LO
DRIVE LO
ENCE
MISTOR
MISTOR
OUTER)
IVE HI
MISTOR
ΦA HI
ΦB HI
DRIVE #1
NER)

J6 / P6

1	BUFFERED RATE HI
2	NOT WIRED
3	NOT WIRED
4	+10 VDC
5	-10 VDC
6	NOT WIRED
7	NOT WIRED
8	RESET QUANTIZER
9	START DUTY CYCLE LIMIT SIGNAL *
10	DUTY CYCLE LIMIT SIGNAL
11	CLOCK FREQ. 153.6 KHZ
12	SUSPENSION CURRENT TG
13	SUSPENSION CURRENT SG
14	HEATER NO. 1 HI 4.5W WINDING
15	HEATER NO. 1 LO 4.5W WINDING
16	HEATER NO. 2 HI 7.5W WINDING
17	HEATER NO. 2 LO 7.5W WINDING
18	SIM TORQUING SIGNAL
19	SUSP-TP
20	WIRED SPARE
21	ANALOG GND
22	+15 VDC
23	WIRED SPARE
24	WIRED SPARE
25	SIM TORQUING COMMAND
26	BUFFERED QUANTIZER OUTPUT
27	START SAWTOOTH
28	WIRED SPARE
29	MICROSYN DRIVE LO
30	CONTROL THERMISTOR
31	WHEEL POWER ΦA LO
32	WHEEL POWER ΦB LO
33	SUSPENSION DRIVE LO
34	DEMOD REFERENCE
35	MONITOR THERMISTOR
36	MONITOR THERMISTOR
37	WIRED SPARE
38	LOGIC GND
39	+5 VDC
40	WIRED SPARE
41	SHIELD (OUTER)
42	GAIN CONTROL
43	MODE CONTROL
44	WIRED SPARE
45	MICROSYN DRIVE HI
46	CONTROL THERMISTOR
47	WHEEL POWER ΦA HI
48	WHEEL POWER ΦB HI
49	SUSPENSION DRIVE #1
50	SHIELD (INNER)

J10 / P10

1	BUFFERED RATE HI
2	NOT WIRED
3	NOT WIRED
4	+10 VDC
5	-10 VDC
6	NOT WIRED
7	NOT WIRED
8	RESET QUANTIZER
9	START DUTY CYCLE LIMIT SIGNAL *
10	DUTY CYCLE LIMIT SIGNAL
11	CLOCK FREQ. 153.6 KHZ
12	SUSPENSION CURRENT TG
13	SUSPENSION CURRENT SG
14	HEATER NO. 1 HI 4.5W WINDING
15	HEATER NO. 1 LO 4.5W WINDING
16	HEATER NO. 2 HI 7.5W WINDING
17	HEATER NO. 2 LO 7.5W WINDING
18	SIM TORQUING SIGNAL
19	SUSP-TP
20	WIRED SPARE
21	ANALOG GND
22	+15 VDC
23	WIRED SPARE
24	WIRED SPARE
25	SIM TORQUING COMMAND
26	BUFFERED QUANTIZER OUTPUT
27	START SAWTOOTH
28	WIRED SPARE
29	MICROSYN DRIVE LO
30	CONTROL THERMISTOR
31	WHEEL POWER ΦA LO
32	WHEEL POWER ΦB LO
33	SUSPENSION DRIVE LO
34	DEMOD REFERENCE
35	MONITOR THERMISTOR
36	MONITOR THERMISTOR
37	WIRED SPARE
38	LOGIC GND
39	+5 VDC
40	WIRED SPARE
41	SHIELD (OUTER)
42	GAIN CONTROL
43	MODE CONTROL
44	WIRED SPARE
45	MICROSYN DRIVE HI
46	CONTROL THERMISTOR
47	WHEEL POWER ΦA HI
48	WHEEL POWER ΦB HI
49	SUSPENSION DRIVE #1
50	SHIELD (INNER)

*4 | GYRO *5 | GYRO *6

REVISIONS			
LTR	DESCRIPTION	DATE	APP'D
A	REVISED	6-27-73	FB
B	REVISED CRT 520753-1	6-11-76	SJW
C	CE-P523821 REFER	8-31-77	

NOTES

J_1 - 311 P 407-5S-B-15 MATES WITH 311 P 407-5P-B-15

J_2 - 311 P 407-6S-B-15 MATES WITH - 311 P 407-6P-B-15

J_3 - 311 P 407-5S-B-15 MATES WITH - 311 P 407-5P-B-15

J_4 - 311 P 407-2P-B-15 MATES WITH - 311 P 407-2S-B-15

P_5 - P_{10} - CANNON DDMAM50P (MIL M 24308/3-5) ALL KEYED

J_5 - J_{10} - CANNON DDMAM50S (MIL M 24308/2-5) ALL KEYED TO P_5-P_{10}

Bendix GUIDANCE SYSTEMS DIVISION

THE BENDIX CORPORATION NAVIGATION & CONTROL DIVISION TETERBORO, NEW JERSEY, U.S.A.

IUE/IRA PIN FUNCTION DIAGRAM

SIZE	CODE IDENT. NO.	
E	19315	5114038

FOLDOUT FRAME 4

FUNCTION	CONNECTOR	PIN#	INPUT	OUTPUT	Z_S or Z_L
+28 VDC BUSS #1 HI	POWER (J4)	1	X		R= Ω
+28 VDC BUSS #1 HI	"	2	X		R= Ω
+28 VDC BUSS #2 HI	"	3	X		R= Ω
+28 VDC BUSS #2 HI	"	4	X		R= Ω
+28 VDC BUSS #3 HI	"	5	X		R= Ω
+28 VDC BUSS #3 HI	"	6	X		R= Ω
+28 VDC BUSS #4 HI	"	7	X	62.2	R= Ω
+28 VDC BUSS #4 HI	"	8	X	Ω	R= Ω
+28 VDC BUSS #5 HI	"	9	X		R= Ω
+28 VDC BUSS #5 HI	"	10	X		R= Ω
+28 VDC BUSS #6 HI	"	11	X		R= Ω
+28 VDC BUSS #6 HI	"	12	X		R= Ω
+28 VDC BUSS #7 HI	"	13	X		R= Ω
+28 VDC BUSS #7 HI	"	14	X		R= Ω
+28 VDC BUSS #8 HI	"	15	X	509	R= Ω
+28 VDC BUSS #8 HI	"	16	X	Ω	R= Ω
DC POWER GROUND	"	17	X		
DC POWER GROUND	"	18	X		
DC POWER GROUND	"	19	X		
DC POWER GROUND	"	20	X		
SPARE	"	21			
SPARE	"	22			
SPARE	"	23			
SPARE	"	24			
SPARE	"	25			
SHIELD	"	26			
SPARE	SIGNAL #1	1			
SPARE	" (J1)	2			
SPARE	"	3			
SPARE	"	4			
DATA WORD, COMMON 'A', CD 'A'	"	5	X		100K Ω
ENVELOPE, COMMON 'A', CD 'A'	"	6	X		100K Ω
SHIFT, COMMON 'A', CD 'A'	"	7	X		100K Ω
DATA WORD, COMMON 'B', CD 'A'	"	8	X		100K Ω
ENVELOPE, COMMON 'B', CD 'A'	"	9	X		100K Ω
SHIFT, COMMON 'B', CD 'A'	"	10	X		100K Ω
GYRO #1 $\Delta\theta$, DMU 'A'	"	11		X	1K Ω
GYRO #2 $\Delta\theta$, DMU 'A'	"	12		X	1K Ω

DETAILED ELECTRICAL INTERFACE

OUTPUT	Z_S or Z_L	CKT. TYPE	VOLT. RANGE	REMARKS
	R= Ω	B-1	+28 VDC	PINS 1&2 TIED INTERNALLY AT RFI FILTER
	R= Ω	B-1	+28 VDC	
	R= Ω	B-2	+28 VDC	PINS 3&4 TIED INTERNALLY AT RFI FILTER
	R= Ω	B-2	+28 VDC	
	R= Ω	B-3	+28 VDC	PINS 5&6 TIED INTERNALLY AT RFI FILTER
	R= Ω	B-3	+28 VDC	
62.2	R= Ω	B-4	+28 VDC	PINS 7&8 TIED INTERNALLY AT RFI FILTER
Ω	R= Ω	B-4	+28 VDC	
	R= Ω	B-5	+28 VDC	PINS 9&10 TIED INTERNALLY AT RFI FILTER
	R= Ω	B-5	+28 VDC	
	R= Ω	B-6	+28 VDC	PINS 11&12 TIED INTERNALLY AT RFI FILTER
	R= Ω	B-6	+28 VDC	
	R= Ω	B-7	+28 VDC	PINS 13&14 TIED INTERNALLY AT RFI FILTER
	R= Ω	B-7	+28 VDC	
509	R= Ω	B-8	+28 VDC	PINS 15&16 TIED INTERNALLY AT RFI FILTER
Ω	R= Ω	B-8	+28 VDC	
			0 VDC	PINS 17&18 TIED INTERNALLY AT RFI FILTER
			0 VDC	
			0 VDC	PINS 19&20 TIED INTERNALLY AT RFI FILTER
			0 VDC	
				WILL PICK UP ALL RFI FILTER SHIELDS INTERNALLY
	100K Ω	DI-1	LOGIC LEVEL	"1" = 3.4-10VDC, "0" = 0-1.5 VDC
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
X	1K Ω	DO-1	"	"1" = 3.5-5.5VDC, "0" = 0-0.4 VDC
X	1K Ω	DO-1	"	"

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DETAILED ELECTRICAL
(CONTINUED)

FUNCTION	CONNECTOR	PIN#	INPUT	OUTPUT	Z_S or Z_L	CKT
GYRO #3 $\Delta\theta$, DMU 'A'	SIGNAL #1	13		X	1K Ω	DO-
GYRO #4 $\Delta\theta$, DMU 'A'	" (J1)	14		X	1K Ω	DO-
GYRO #5 $\Delta\theta$, DMU 'A'	"	15		X	1K Ω	DO-
GYRO #6 $\Delta\theta$, DMU 'A'	"	16		X	1K Ω	DO-
GYRO #1 ENVELOPE, DMU 'A'	"	17	X		100K Ω	DI-
GYRO #2 ENVELOPE, DMU 'A'	"	18	X		100K Ω	DI-
GYRO #3 ENVELOPE, DMU 'A'	"	19	X		100K Ω	DI-
GYRO #4 ENVELOPE, DMU 'A'	"	20	X		100K Ω	DI-
GYRO #5 ENVELOPE, DMU 'A'	"	21	X		100K Ω	DI-
GYRO #6 ENVELOPE, DMU 'A'	"	22	X		100K Ω	DI-
GYRO #1 SHIFT, DMU 'A'	"	23	X		100K Ω	DI-
GYRO #2 SHIFT, DMU 'A'	"	24	X		100K Ω	DI-
GYRO #3 SHIFT, DMU 'A'	"	25	X		100K Ω	DI-
GYRO #4 SHIFT, DMU 'A'	"	26	X		100K Ω	DI-
GYRO #5 SHIFT, DMU 'A'	"	27	X		100K Ω	DI-
GYRO #6 SHIFT, DMU 'A'	"	28	X		100K Ω	DI-
DMU 'A', INTERROGATE	"	29	X		3.3K Ω	DI-
DMU 'A', INTERROGATE	"	30	X		3.3K Ω	DI-
STATUS WORD, COM. 'A', DMU 'A'	"	31			511 Ω	DO-
WORD GATE, COM. 'A', DMU 'A'	"	32	X		3.3K Ω	DI-
SHIFT, COM. 'A', DMU 'A'	"	33	X		2.2K Ω	DI-
STATUS WORD, COM. 'B', DMU 'A'	"	34		X	511 Ω	DO-
WORD GATE, COM. 'B', DMU 'A'	"	35	X		3.3K Ω	DI-
SHIFT, COM. 'B', DMU 'A'	"	36	X		2.2K Ω	DI-
LOGIC GROUND	"	37				
LOGIC GROUND	"	38				
BODY RATE, COM. 'A' ω zc HI	"	39		X	1KΩ	AO-
BODY RATE, COM. 'A' ω yc HI	"	40		X	1KΩ	AO-
BODY RATE, COM. 'A' ω xc HI	"	41		X	1KΩ	AO-
BODY RATE, COM. 'A' GROUND	"	42				
BODY RATE, COM. 'A' ω zc HI, DMU'A', T/M	"	43		X	4.99K Ω	AO-
BODY RATE, COM. 'A' ω yc HI, DMU'A', T/M	"	44		X	4.99K Ω	AO-
BODY RATE, COM. 'A' ω xc HI, DMU'A', T/M	"	45		X	4.99K Ω	AO-
GYRO #1 TEMP, DMU 'A' T/M	"	46		X	4.99K Ω	AO-
GYRO #3 TEMP, DMU 'A' T/M	"	47		X	4.99K Ω	AO-
GYRO #5 TEMP, DMU 'A' T/M	"	48		X	4.99K Ω	AO-
ECU TEMP #1, DMU 'A' T/M	"	49		X	VARIABLE	
ECU TEMP #2, DMU 'A' T/M	"	50		X	VARIABLE	

ORIGINAL PAGE IS OF POOR QUALITY

FOLDOUT FRAME 1

DETAILED ELECTRICAL INTERFACE
(CONTINUED)

OUTPUT	Z_S or Z_L	CKT. TYPE	VOLT. RANGE	REMARKS
X	1K Ω	DO-1	LOGIC LEVEL	"1" = 3.5-5.5 VDC, "0" = 0-0.4 VDC
X	1K Ω	DO-1	"	"
X	1K Ω	DO-1	"	"
X	1K Ω	DO-1	"	"
	100K Ω	DI-1	"	"1" = 3.5-10 VDC, "0" = 0-1.5 VDC
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	100K Ω	DI-1	"	"
	3.3K Ω	DI-1	"	"
	3.3K Ω	DI-1	"	"
	511 Ω	DO-1	"	"1" = 3.5-5.5 VDC, "0" = 0-0.4 VDC
	3.3K Ω	DI-2	"	
	2.2K Ω	DI-3	"	
X	511 Ω	DO-1	"	"1" = 3.5-5.5 VDC, "0" = 0-0.4 VDC
	3.3K Ω	DI-2	"	
	2.2K Ω	DI-3	"	
X	1KΩ	AO-1	± 5VDC, 22 ma	SHIELD EXTERNAL TO IRA, 1V/°/SEC, 0.05V/SEC/SE[illegible]
X	1KΩ	AO-1	± 5VDC, 22 ma	SHIELD EXTERNAL TO IRA, 1V/°/SEC, 0.05V/SEC/SEC
X	1KΩ	AO-1	± 5VDC, 22ma	SHIELD EXTERNAL TO IRA, 1V/°/SEC, 0.05V/SEC/SEC
X	4.99K Ω	AO-2	-0.7 TO +5.6VDC	±100 SEC/SEC OR ± 5°/SEC RANGE = 0-5VDC
X	4.99K Ω	AO-2	"	+100 SEC/SEC OR + 5°/SEC RANGE = 0-5VDC
X	4.99K Ω	AO-2	"	±100 SEC/SEC OR ± 5°/SEC RANGE = 0-5VDC
X	4.99K Ω	AO-2	"	27 mv/°F, 135°F = 3 VOLTS DC
X	4.99K Ω	AO-2	"	27 mv/°F, 135°F = 3 VOLTS DC
X	4.99K Ω	AO-2	"	27 mv/°F, 135°F = 3 VOLTS DC
X	VARIABLE		RESISTANCE	YSI THERMISTOR, ONE SIDE GNDED
X	VARIABLE		RESISTANCE	YSI THERMISTOR, ONE SIDE GNDED

FOLDOUT FRAME

Issue: Rev. B

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DETAILED ELECTRICAL
(CONTINUED)

FUNCTION	CONNECTOR	PIN#	INPUT	OUTPUT	Z_S or Z_L	CKT
GYRO #1 ΦB MOTOR CURRENT, DMU 'A', T/M	SIGNAL #1	51		X	4.99K Ω	AO
GYRO #3 ΦB MOTOR CURRENT, DMU 'A', T/M	" (J1)	52		X	4.99K Ω	AO
GYRO #5 ΦB MOTOR CURRENT, DMU 'A', T/M	"	53		X	4.99K Ω	AO
ANALOG GROUND	"	54				
ANALOG GROUND	"	55				
GYRO #1 RATE HI, DMU 'A', T/M	"	56		X	4.99K Ω	AO
GYRO #3 RATE HI, DMU 'A', T/M	"	57		X	4.99K Ω	AO
GYRO #5 RATE HI, DMU 'A', T/M	"	58		X	4.99K Ω	AO
BODY RATE.COM.'B' ω zc HI,DMU'A' T/M	"	59		X	4.99K Ω	AO
BODY RATE.COM.'B' ω yc HI,DMU'A' T/M	"	60		X	4.99K Ω	AO
BODY RATE.COM.'B' ω xc HI,DMU'A' T/M	"	61		X	4.99K Ω	AO
GYRO #2 TEMP, DMU 'A' T/M	"	62		X	4.99K Ω	AO
GYRO #4 TEMP, DMU 'A' T/M	"	63		X	4.99K Ω	AO
GYRO #6 TEMP, DMU 'A' T/M	"	64		X	4.99K Ω	AO
GYRO #2 ΦB MOTOR CURRENT, DMU 'A' T/M	"	65		X	4.99K Ω	AO
GYRO #4 ΦB MOTOR CURRENT, DMU 'A' T/M	"	66		X	4.99K Ω	AO
GYRO #6 ΦB MOTOR CURRENT, DMU 'A' T/M	"	67		X	4.99K Ω	AO
GYRO #2 RATE HI, DMU 'A' T/M	"	68		X	4.99K Ω	AO
GYRO #4 RATE HI, DMU 'A' T/M	"	69		X	4.99K Ω	AO
GYRO #6 RATE HI, DMU 'A' T/M	"	70		X	4.99K Ω	AO
SPARE	"	71				
SPARE	"	72				
SPARE	"	73				
SPARE	"	74				
SPARE	"	75				
SPARE	"	76				
SPARE	"	77				
SHIELD	"	78				
SPARE	SIGNAL #2	1				
SPARE	" (J3)	2				
SPARE	"	3				
SPARE	"	4				
DATA WORD, COMMON 'A', CD 'B'	"	5	X		100K Ω	DI
ENVELOPE, COMMON 'A', CD 'B'	"	6	X		100K Ω	DI
SHIFT, COMMON 'A', CD 'B'	"	7	X		100K Ω	DI
DATA WORD, COMMON 'B', CD 'B'	"	8	X		100K Ω	DI
ENVELOPE, COMMON 'B', CD 'B'	"	9	X		100K Ω	DI
SHIFT, COMMON 'B', CD 'B'	"	10	X		100K Ω	DI

FOLDOUT FRAME 1

DETAILED ELECTRICAL INTERFACE
(CONTINUED)

OUTPUT	Z_S or Z_L	CKT. TYPE	VOLT. RANGE	REMARKS
X	4.99K Ω	AO-2	-0.7 TO +5.6VDC	0-5 VDC = 0 TO 600 ma GYRO CURRENT
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	-0.7 TO +5.6VDC	0-5 VDC = $\pm$ 600 SEC/SEC OR $\pm$ 5°/SEC
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	$\pm$ 100 SEC/SEC OR $\pm$ 5°/SEC = 0-5 VDC
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	27 mv/°F, 135°F = 3 VOLTS DC
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	0-5 VDC = 0 TO 600 ma GYRO CURRENT
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	0-5 VDC = $\pm$ 600 SEC/SEC OR $\pm$ 5°/SEC
X	4.99K Ω	AO-2	"	"
X	4.99K Ω	AO-2	"	"
				(NOTE) - FOR ALL REMARKS ON SIGNAL #2
				CONNECTOR SEE CORRESPONDING SIGNAL #1
				PIN NUMBER
	100K Ω	DI-1	LOGIC LEVEL	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	

FOLDOUT FRAME 2

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Date: 20 January 1975

DETAILED ELECTRICAL
(CONTINUED)

FUNCTION	CONNECTOR	PIN#	INPUT	OUTPUT	Z_S or Z_L	CKT
GYRO #1 $\Delta\theta$, DMU 'B'	SIGNAL #2	11		X	1K Ω	
GYRO #2 $\Delta\theta$, DMU 'B'	" (J3)	12		X	1K Ω	
GYRO #3 $\Delta\theta$, DMU 'B'	"	13		X	1K Ω	
GYRO #4 $\Delta\theta$, DMU 'B'	"	14		X	1K Ω	
GYRO #5 $\Delta\theta$, DMU 'B'	"	15		X	1K Ω	
GYRO #6 $\Delta\theta$, DMU 'B'	"	16		X	1K Ω	
GYRO #1 ENVELOPE, DMU 'B'	"	17	X		100K Ω	
GYRO #2 ENVELOPE, DMU 'B'	"	18	X		100K Ω	
GYRO #3 ENVELOPE, DMU 'B'	"	19	X		100K Ω	
GYRO #4 ENVELOPE, DMU 'B'	"	20	X		100K Ω	
GYRO #5 ENVELOPE, DMU 'B'	"	21	X		100K Ω	
GYRO #6 ENVELOPE, DMU 'B'	"	22	X		100K Ω	
GYRO #1 SHIFT, DMU 'B'	"	23	X		100K Ω	
GYRO #2 SHIFT, DMU 'B'	"	24	X		100K Ω	
GYRO #3 SHIFT, DMU 'B'	"	25	X		100K Ω	
GYRO #4 SHIFT, DMU 'B'	"	26	X		100K Ω	
GYRO #5 SHIFT, DMU 'B'	"	27	X		100K Ω	
GYRO #6 SHIFT, DMU 'B'	"	28	X		100K Ω	
DMU 'B' INTERROGATE	"	29	X		3.3K Ω	
DMU 'B' INTERROGATE	"	30	X		3.3K Ω	
STATUS WORD, COM. 'A', DMU 'B'	"	31			511 Ω	
WORD GATE, COM. 'A', DMU 'B'	"	32	X		3.3K Ω	
SHIFT, COM. 'A', DMU 'B'	"	33	X		2.2K Ω	
STATUS WORD, COM. 'B', DMU 'B'	"	34			511 Ω	
WORD GATE, COM. 'B', DMU 'B'	"	35	X		3.3K Ω	
SHIFT, COM. 'B', DMU 'B'	"	36	X		2.2K Ω	
LOGIC GROUND	"	37				
LOGIC GROUND	"	38				
BODY RATE, COM. 'B' ω zc HI	"	39		X	1K Ω	
BODY RATE, COM. 'B' ω yc HI	"	40		X	1K Ω	
BODY RATE, COM. 'B' ω xc HI	"	41		X	1K Ω	
BODY RATE, COM. 'B' GROUND	"	42				
BODY RATE, COM. 'A' ω zc HI, DMU 'B', T/M	"	43		X		
BODY RATE, COM. 'A' ω yc HI, DMU 'B', T/M	"	44		X		
BODY RATE, COM. 'A' ω xc HI, DMU 'B', T/M	"	45		X		

FOLDOUT FRAME

DETAILED ELECTRICAL INTERFACE
(CONTINUED)

OUTPUT	Z_S or Z_L	CKT. TYPE	VOLT. RANGE	REMARKS
X	1K Ω	DO-1	LOGIC LEVEL	NOTE - FOR ALL REMARKS ON SIGNAL #2
X	1K Ω	DO-1	"	CONNECTOR SEE CORRESPONDING SIGNAL #1
X	1K Ω	DO-1	"	PIN NUMBER
X	1K Ω	DO-1	"	
X	1K Ω	DO-1	"	
X	1K Ω	DO-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	100K Ω	DI-1	"	
	3.3K Ω	DI-1	"	
	3.3K Ω	DI-1	"	
	511 Ω	DO-1	"	
	3.3K Ω	DI-2	"	
	2.2K Ω	DI-3	"	
	511 Ω	DO-1	"	
	3.3K Ω	DI-2	"	
	2.2K Ω	DI-3	"	
X	1K Ω	AO-1	± 5VDC 22 MA	
X	1K Ω	AO-1	± 5VDC 22 MA	
X	1K Ω	AO-1	± 5VDC 22 MA	
X		AO-2	-0.7 TO +5.6VDC	
X		AO-2	"	
X		AO-2	"	

FOLDOUT FRAME

2

Issue: Rev. B

Date: 20 January 1975

DETAILED ELECTRICAL
(CONTINUED)

FUNCTION	CONNECTOR	PIN#	INPUT	OUTPUT	Z_S or Z_L	CKT
GYRO #1 TEMP. DMU 'B' T/M	SIGNAL #2	46		X	4.99K Ω	AC
GYRO #3 TEMP. DMU 'B' T/M	" (J3)	47		X	4.99K Ω	AC
GYRO #5 TEMP. DMU 'B' T/M	"	48		X	4.99K Ω	AC
ECU TEMP #1, DMU 'B' T/M	"	49		X	VARIABLE	
ECU TEMP #2, DMU 'B' T/M	"	50		X	VARIABLE	
GYRO #1 ΦB MOTOR CURRENT, DMU 'B' T/M	"	51		X	4.99K Ω	AC
GYRO #3 ΦB MOTOR CURRENT, DMU 'B' T/M	"	52		X	4.99K Ω	AC
GYRO #5 ΦB MOTOR CURRENT, DMU 'B' T/M	"	53		X	4.99K Ω	AC
ANALOG GROUND	"	54				
ANALOG GROUND	"	55				
GYRO #1 RATE HI, DMU 'B' T/M	"	56		X	4.99K Ω	AC
GYRO #3 RATE HI, DMU 'B' T/M	"	57		X	4.99K Ω	AC
GYRO #5 RATE HI, DMU 'B' T/M	"	58		X	4.99K Ω	AC
BODY RATE, COM. 'B' ω zc HI, DMU 'B', T/M	"	59		X	4.99K Ω	AC
BODY RATE, COM. 'B' ω yc HI, DMU 'B', T/M	"	60		X	4.99K Ω	AC
BODY RATE, COM. 'B' ω xc HI, DMU 'B', T/M	"	61		X	4.99K Ω	AC
GYRO #2 TEMP, DMU 'B' T/M	"	62		X	4.99K Ω	AC
GYRO #4 TEMP, DMU 'B' T/M	"	63		X	4.99K Ω	AC
GYRO #6 TEMP, DMU 'B' T/M	"	64		X	4.99K Ω	AC
GYRO #2 ΦB MOTOR CURRENT, DMU 'B' T/M	"	65		X	4.99K Ω	AC
GYRO #4 ΦB MOTOR CURRENT, DMU 'B' T/M	"	66		X	4.99K Ω	AC
GYRO #6 ΦB MOTOR CURRENT, DMU 'B' T/M	"	67		X	4.99K Ω	AC
GYRO #2 RATE HI, DMU 'B', T/M	"	68		X	4.99K Ω	AC
GYRO #4 RATE HI, DMU 'B' T/M	"	69		X	4.99K Ω	AC
GYRO #6 RATE HI, DMU 'B' T/M	"	70		X	4.99K Ω	AC
SPARE	"	71				
SPARE	"	72				
SPARE	"	73				
SPARE	"	74				
SPARE	"	75				
SPARE	"	76				
SPARE	"	77				
SHIELD	"	78				

FOLDOUT FRAME 2

DETAILED ELECTRICAL INTERFACE
(CONTINUED)

OUTPUT	Z_S or Z_L	CKT. TYPE	VOLT. RANGE	REMARKS
X	4.99K Ω	AO-2	-0.7 TO +5.6 VDC	NOTE - FOR ALL REMARKS ON SIGNAL #2
X	4.99K Ω	AO-2	"	CONNECTOR SEE CORRESPONDING SIGNAL
X	4.99K Ω	AO-2	"	#1 PIN NUMBER.
X	VARIABLE		RESISTANCE	
X	VARIABLE		RESISTANCE	
X	4.99K Ω	AO-2	-0.7 TO +5.6 VDC	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	-0.7 TO 5.6 VDC	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4 9[illegible] Ω	AO-2	"	
X	[illegible].99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	
X	4.99K Ω	AO-2	"	

DETAILED ELECTRICAL
(CONTINUED)

FUNCTION	CONNECTOR	PIN#	INPUT	OUTPUT	Z_S or Z_L	CKT
+15 VDC, GYRO #1	TEST (J2)	1		X	100K Ω	
+10 VDC, GYRO #1	"	2		X	100K Ω	
-10 VDC, GYRO #1	"	3		X	100K Ω	
+ 5 VDC, GYRO #1	"	4		X	100K Ω	
+15 VDC, GYRO #2	"	5		X	100K Ω	
+10 VDC, GYRO #2	"	6		X	100K Ω	
-10 VDC, GYRO #2	"	7		X	100K Ω	
+ 5 VDC, GYRO #2	"	8		X	100K Ω	
+15 VDC, GYRO #3	"	9		X	100K Ω	
+10 VDC, GYRO #3	"	10		X	100K Ω	
-10 VDC, GYRO #3	"	11		X	100K Ω	
+ 5 VDC, GYRO #3	"	12		X	100K Ω	
+15 VDC, GYRO #4	"	13		X	100K Ω	
+10 VDC, GYRO #4	"	14		X	100K Ω	
-10 VDC, GYRO #$	"	15		X	100K Ω	
+ 5 VDC, GYRO #4	"	16		X	100K Ω	
+15 VDC, GYRO #5	"	17		X	100K Ω	
+10 VDC, GYRO #5	"	18		X	100K Ω	
-10 VDC, GYRO #5	"	19		X	100K Ω	
+ 5 VDC, GYRO #5	"	20		X	100K Ω	
+15 VDC, GYRO #6	"	21		X	100K Ω	
+10 VDC, GYRO #6	"	22		X	100K Ω	
-10 VDC, GYRO #6	"	23		X	100K Ω	
+ 5 VDC, GYRO #6	"	24		X	100K Ω	
SIM. TORQUING COMMAND	"	25	X			DI
SIM. TORQ. SIG. GYRO #1	"	26	X		4.7K Ω	
SIM. TORQ. SIG. GYRO #2	"	27	X		4.7K Ω	
SIM. TORQ. SIG. GYRO #3	"	28	X		4.7K Ω	
SIM. TORQ. SIG. GYRO #4	"	29	X		4.7K Ω	
SIM. TORQ. SIG. GYRO #5	"	30	X		4.7K Ω	
SIM. TORQ. SIG. GYRO #6	"	31	X		4.7K Ω	
MICROSYN EXC. GYRO #1 HI	"	32		X	10 K Ω	
MICROSYN EXC. GYRO #2 HI	"	33		X	10 K Ω	
MICROSYN EXC. GYRO #3 HI	"	34		X	10K Ω	
MICROSYN EXC. GYRO #4 HI	"	35		X	10K Ω	
MICROSYN EXC. GYRO #5 HI	"	36		X	10K Ω	
MICROSYN EXC. GYRO #6 HI	"	37		X	10K Ω	

FOLDOUT FRAME

DETAILED ELECTRICAL INTERFACE
(CONTINUED)

OUTPUT	Z_S or Z_L	CKT. TYPE	VOLT. RANGE	REMARKS
X	100K Ω		VALUE ± 5%	100K Ω IN SERIES WITH SUPPLY
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
X	100K Ω		"	"
		DI-4		REQUIRES GROUNDING TO ACTIVATE COMMAND
	4.7K Ω		± 5 VDC	
	4.7K Ω		± 5 VDC	
	4.7K Ω		"	
	4.7K Ω		"	
	4.7K Ω		"	
	4.7K Ω		"	
X	10 K Ω		2VRMS ± 2%	9.6 KHz
X	10 K Ω		"	"
X	10K Ω		"	"
X	10K Ω		"	"
X	10K Ω		"	"
X	10K Ω		"	"

FOLDOUT FRAME

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Issue: Rev. B

Date: 20 January 1975

DETAILED ELECTRICA
(CONTINUED)

FUNCTION	CONNECTOR	PIN#	INPUT	OUTPUT	Z_S or Z_L	CK
GYRO #1 HTR DUTY CYCLE HI	"	44		X	100K Ω	
GYRO #2 HTR DUTY CYCLE HI	"	45		X	100K Ω	
GYRO #3 HTR DUTY CYCLE HI	"	46		X	100K Ω	
GYRO #4 HTR DUTY CYCLE HI	"	47		X	100K Ω	
GYRO #5 HTR DUTY CYCLE HI	"	48		X	100K Ω	
GYRO #6 HTR DUTY CYCLE HI	"	49		X	100K Ω	
HTR DUTY CYCLE GND	"	50				
4V SUSP. COMMAND	"	51	X			D
FF COMMAND	"	52	X			D
SPARE	"	53				
SPARE	"	54				
SPARE	"	55				
GYRO #1 WHEEL VOLTS ΦA HI	"	56		X	10K Ω	
GYRO #1 WHEEL VOLTS ΦA LO	"	57		X	10K Ω	
GYRO #2 WHEEL VOLTS ΦA HI	"	58		X	10K Ω	
GYRO #2 WHEEL VOLTS ΦA LO	"	59		X	10K Ω	
GYRO #3 WHEEL VOLTS ΦA HI	"	60		X	10K Ω	
GYRO #3 WHEEL VOLTS ΦA LO	"	61		X	10K Ω	
GYRO #4 WHEEL VOLTS ΦA HI	"	62		X	10K Ω	
GYRO #4 WHEEL VOLTS ΦA LO	"	63		X	10K Ω	
GYRO #5 WHEEL VOLTS ΦA HI	"	64		X	10K Ω	
GYRO #5 WHEEL VOLTS ΦA LO	"	65		X	10K Ω	
GYRO #6 WHEEL VOLTS ΦA HI	"	66		X	10K Ω	
GYRO #6 WHEEL VOLTS ΦA LO	"	67		X	10K Ω	
WHEELS DISABLE	"	68	X			D
SUSP. EXC. GYRO #1 HI	"	69		X	1K	
SUSP. EXC. GYRO #2 HI	"	70		X	1K	
SUSP. EXC. GYRO #3 HI	"	71		X	1K	
SUSP. EXC. GYRO #4 HI	"	72		X	1K	
SUSP. EXC. GYRO #5 HI	"	73		X	1K	
SUSP. EXC. GYRO #6 HI	"	74		X	1K	
SUSP. CURR. GYRO #1 TG LO	"	75		X	1K	
SUSP. CURR. GYRO #1 SG LO	"	76		X	1K	

FOLDOUT FRAME

DETAILED ELECTRICAL INTERFACE
(CONTINUED)

UT	OUTPUT	Z_S or Z_L	CKT. TYPE	VOLT. RANGE	REMARKS
			. . . .		
	X	100K Ω		28VDC OR 0 VDC	600 Hz PWM WAVEFORM
	X	100K Ω		"	"
	X	100K Ω		"	"
	X	100K Ω		"	"
	X	100K Ω		"	"
	X	100K Ω		"	"
X			DI-4		REQUIRE GROUNDING TO ACTIVATE COMMAND
X			DI-4		REQUIRE GROUNDING TO ACTIVATE COMMAND
	X	10K Ω		34VRMS OR18VRMS	± 5% ON VOLTAGE, 960 Hz
	X	10K Ω			
	X	10K Ω		34VRMS OR 18VRMS	± 5% ON VOLTAGE, 960 Hz
	X	10K Ω			
	X	10K Ω		34VRMS OR 18VRMS	± 5% ON VOLTAGE, 960 Hz
	X	10K Ω			
	X	10K Ω		34VRMS OR 18VRMS	± 5% ON VOLTAGE, 960 Hz
	X	10K Ω			
	X	10K Ω		34VRMS OR 18VRMS	± 5% ON VOLTAGE, 960 Hz
	X	10K Ω			
	X	10K Ω		34VRMS OR 18VRMS	± 5% ON VOLTAGE, 960 Hz
	X	10K Ω			
X			DI-4		REQUIRE GROUNDING TO ACTIVATE COMMAND
	X	1K		2.5 OR 4 VRMS	± 2% ON VOLTAGE, 9.6 KHz
	X	1K		"	"
	X	1K		"	"
	X	1K		"	"
	X	1K		"	"
	X	1K		"	"
	X	1K		50 MV RANGE	1 Ω RESISTOR
	X	1K		"	"

Issue: Rev. B

Date: 20 January 1975

DETAILED ELECTRICAL
(CONCLUDED)

FUNCTION	CONNECTOR	PIN#	INPUT	OUTPUT	Z_S or Z_L	CK
SUSP. CURR. GYRO #2 TG LO	TEST (J2)	77		X	1 K Ω	
SUSP. CURR. GYRO #2 SG LO	"	78		X	1 K Ω	
SUSP. CURR. GYRO #3 TG LO	"	79		X	1 K Ω	
SUSP. CURR. GYRO #3 SG LO	"	80		X	1 K Ω	
SUSP. CURR. GYRO #4 TG LO	"	81		X	1 K Ω	
SUSP. CURR. GYRO #4 SG LO	"	82		X	1 K Ω	
SUSP. CURR. GYRO #5 TG LO	"	83		X	1 K Ω	
SUSP. CURR. GYRO #5 SG LO	"	84		X	1 K Ω	
SUSP. CURR. GYRO #6 TG LO	"	85		X	1 K Ω	
SUSP. CURR. GYRO #6 SG LO	"	86		X	1 K Ω	
BUFF. RATE GYRO #1 HI	"	87		X	100 Ω	A
BUFF. RATE GYRO #2 HI	"	88		X	100 Ω	A
BUFF. RATE GYRO #3 HI	"	89		X	100 Ω	A
BUFF. RATE GYRO #4 HI	"	90		X	100 Ω	A
BUFF. RATE GYRO #5 HI	"	91		X	100 Ω	A
BUFF. RATE GYRO #6 HI	"	92		X	100 Ω	A
307.2 KHz COM. 'A'	"	93		X	4.7 K Ω	D
307.2 KHz COM. 'B'	"	94		X	4.7 K Ω	D
DETO COM. 'A'	"	95		X	4.7 K Ω	D
DETO COM. 'B'	"	96		X	4.7 K Ω	D
GYRO #1 QUANTIZER OUTPUT	"	97		X	4.7 K Ω	D
GYRO #2 QUANTIZER OUTPUT	"	98		X	4.7 K Ω	D
GYRO #3 QUANTIZER OUTPUT	"	99		X	4.7 K Ω	D
GYRO #4 QUANTIZER OUTPUT	"	100		X	4.7 K Ω	D
GYRO #5 QUANTIZER OUTPUT	"	101		X	4.7 K Ω	D
GYRO #6 QUANTIZER OUTPUT	"	102		X	4.7 K Ω	D
SIGNAL GROUND	"	103				
SHIELD	"	104				

FOLDOUT FRAME

DETAILED ELECTRICAL INTERFACE
(CONCLUDED)

OUTPUT	Z_S or Z_L	CKT. TYPE	VOLT. RANGE	REMARKS
X	1 K Ω		50 MV RANGE	1 Ω RESISTOR
X	1 K Ω		"	"
X	1 K Ω		"	"
X	1 K Ω		"	"
X	1 K Ω		"	"
X	1 K Ω		"	"
X	1 K Ω		"	"
X	1 K Ω		"	"
X	1 K Ω		"	"
X	1 K Ω		"	"
X	100 Ω	AO-1	± 10 VDC	2.34 V = 600 SEC/SEC
X	100 Ω	AO-1	"	"
X	100 Ω	AO-1	"	"
X	100 Ω	AO-1	"	"
X	100 Ω	AO-1	"	"
X	100 Ω	AO-1	"	"
X	4.7 K Ω	DO-1	LOGIC LEVEL	"1" = 3.5-5.5 VDC, "0" = 0-0.4 VDC
X	4.7 K Ω	DO-1	"	"
X	4.7 K Ω	DO-1	"	"
X	4.7 K Ω	DO-1	"	"
X	4.7 K Ω	DO-1	"	"
X	4.7 K Ω	DO-1	"	"
X	4.7 K Ω	DO-1	"	"
X	4.7 K Ω	DO-1	"	"
X	4.7 K Ω	DO-1	"	"
X	4.7 K Ω	DO-1	"	"

12.0 APPENDIX A

IUE FLIGHT SYSTEM

TEST DATA SUMMARY

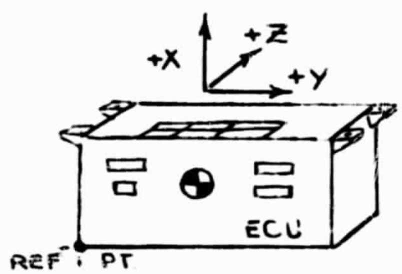
PHYSICAL MEASUREMENT, WEIGHT, POWER, CG

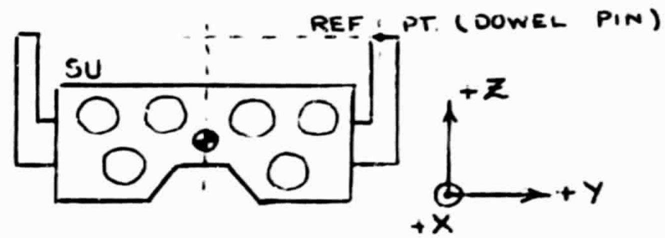
PHYSICAL MEASUREMENTS - MEETS OUTLINE DIMENSIONS

WEIGHT = 48.35 LBS. (21.9KG) SPEC = 39.02 LBS. (17.7KG)

POWER = 74.2 WATTS (IN THERMAL VACUUM) SPEC = 67 WATTS

CENTER OF GRAVITY - CG COORDINATES FROM REFERENCE POINT (CM)





	X	Y	Z
ECU	+2.037	-23.749	-15.194
SU	+0.802	- 9.35	- 5.982

BANDWIDTH MEASUREMENTS

RS#	THROUGH MATRIX OUTPUTS (HZ) RATE COLD $80^{0}F$	THROUGH MATRIX OUTPUTS (HZ) RATE NORMAL $110^{0}F$	THROUGH MATRIX OUTPUTS (HZ) RATE NORMAL $135^{0}F$	THROUGH BUFFERED RATE OUTPUT HOLD-SLEW AT $135^{0}F$
1	2.4	1.4	6.4	8.1
2	2.7	1.6	6.1	7.3
3	2.8	1.6	6.2	9.0
4	2.8	2.0	6.6	10.1
5	2.7	1.7	7.1	9.4
6	3.4	2.0	6.9	10.3
SPEC LIMITS	1.4 HZ	1.4 HZ	4.0 HZ	5.0 HZ

BIAS DRIFT (G AND NON-G SENSITIVE)

	G_1	G_2	G_3	G_4	G_5	G_6	SPEC.
INITIAL PERF							
MUSA	+1.325	+.655	+.131	-.194	+.809	-.543	10^0/HR/G
MUIA	-2.349	-.443	.210	-.107	.533	.166	10^0/HR/G
NON-G SENS	- .032	+.752	+.617	-.222	-.926	-.974	5^0/HR
FINAL PERF							
MUSA	1.041	.883	.132	-.158	.793	-.657	10
MUIA	-1.801	-.734	.064	-.084	.578	.007	10
NON-G SENS	+ .006	+.753	+.625	-.238	-.925	-.965	5
STABILITY							
MUSA	.284	.234	.001	.036	.016	.114	1
MUIA	.548	.291	.146	.023	.045	.173	1
NON-G SENS	.038	.001	.008	.016	.001	.009	0.5

ALIGNMENT DELTAS FROM IDEAL - X AXIS

	G_1	G_2	G_3	G_4	G_5	G_6	SPEC
INITIAL PERF.	-33	14	-211	25	51	64	$\pm$240 ARC SEC
FINAL PERF.	-22	25	-200	10	42	66	$\pm$240 ARC SEC
STABILITY	5.5	5.5	5.5	7.5	4.5	1.0	$\pm$15 ARC SEC

ALIGNMENT DELTAS FROM IDEAL - Y AXIS

	G_1	G_2	G_3	G_4	G_5	G_6	SPEC
INITIAL PERF.	-111	-7	31	-65	107	-80	±240 ARC SEC
FINAL PERF.	-118	-5	23	-22	104	-52	±240 ARC SEC
STABILITY	3.5	1.0	4.0	21.5	1.5	11.0	±15 ARC SEC

ALIGNMENT DELTAS FROM IDEAL - Z AXIS

	G_1	G_2	G_3	G_4	G_5	G_6	SPEC
INITIAL PERF.	55	-90	53	-2	184	-57	±240 ARC SEC
FINAL PERF.	100	-20	22	-43	103	-40	±240 ARC SEC
STABILITY	22.5	35	16.5	20.5	40.5	8.5	±15 ARC SEC

MEAN SCALE FACTORS (DIGITAL) - 3 OCCURRENCES

	G_1	G_2	G_3	G_4	G_5	G_6	SPEC.
H/S MODE	.0101085213	.0100343033	.0100298682	.0100334612	.0101326036	.0100453515	0.01 TO 0.10
RATE MODE	.31376335	.31009669	.311684286	.30861975	.31329002	.311866792	NO REQ'T

C-2

SCALE FACTOR LINEARITY - BIAS METHOD LAST OCCURRENCE

INPUT RATE (^{O}/HR)	G_1	G_2	G_3	G_4	G_5	G_6
+50	-27	91	194	86	-29	-3
-50	+94	103	-127	-54	140	91
+100	-86	32	- 98	12	-71	-76
-100	63	-4	103	-23	59	133
+200	-52	-77	-59	48	-44	-106
-200	11	12	19	-34	31	+61
+300	-49	-73	-52	20	-38	-8
-300	20	4	8	-22	4	-46
+400	-25	-66	-18	51	-14	34
-400	25	21	22	-26	-6	-36
+600	-22	-83	-3	13	-30	-11
-600	49	41	11	-71	-4	-33
LIMIT (PPM)	1000	1000	1000	1000	1000	1000

SCALE FACTOR STABILITY (50 DAYS) - WORST CASE

	G_1	G_2	G_3	G_4	G_5	G_6
$\pm 50^0$/HR	-21	-46	-43	-23	-183	103
$\pm 100^0$/HR	-30	39	-65	16	-144	-104
$\pm 200^0$/HR	-31	-18	-65	-16	-135	-91
$\pm 300^0$/HR	-29	-43	-62	-12	-88	-83
$\pm 400^0$/HR	-29	-48	-66	12	-71	-91
$\pm 600^0$/HR	-38	-42	-66	32	-37	-76
$\bar{M}$	29.6	26.3	61.1	1.5	109.6	57.0

COMPUTE AVERAGES

SPEC LIMIT = 100 PPM/35 DAYS

BIAS DRIFT STABILITY RESULTS

	G_1	G_2	G_3	G_4	G_5	G_6	SPEC
INITIAL PERF.							
RATE RAMP	-0.00007	-0.00002	0.000007	-0.00011	-0.00002	0.00002	0.0004 o/HR/HR
SHORT TERM	0.00123	0.00327	-0.00171	0.00178	-0.00369	0.00237	0.005 o/HR
FINAL PERF.							
RATE RAMP	-0.00006	-0.00018	-0.00004	0.00005	0.00006	0.00008	0.0004
SHORT TERM	0.0011	0.0031	0.0020	0.0019	0.0040	0.0030	0.005

SHORT TERM ATTITUDE NOISE RESULTS

	RS #1	RS #2	RS #3	RS #4	RS #5	RS #6	SPEC.
5 MIN. ABS.	-0.09	-0.09	-0.11	-0.27	-0.04	0.08	1 ARC SEC
30 MIN. ABS.	-0.30	-0.04	0.39	-0.66	-0.25	-0.10	2 ARC SEC
RMS - 5 MIN.	0.06	0.05	0.06	0.07	0.05	0.06	0.33
30 MIN.	0.06	0.05	0.06	0.07	0.05	0.06	0.67
POINT/POINT MAX.	.21	0.20	.20	.20	0.20	0.20	0.20
5 MIN. ABS.	0.26	0.14	-0.12	-0.06	-0.07	-0.23	1 ARC SEC.
30 MIN. ABS.	0.38	0.71	0.03	-0.26	-0.90	-0.87	2 ARC SEC.
RMS - 5 MIN.	0.08	0.06	0.07	0.08	0.06	0.07	0.33
30 MIN.	0.07	0.06	0.07	0.07	0.05	0.07	0.67
POINT/POINT MAX.	0.20	0.20	0.21	0.20	0.20	0.21	0.20

MATRIX OUTPUTS - SCALE FACTOR

MODE	AXIS	MATRIX "A"	MATRIX "B"	SPEC
RATE COLD	X	0.962	0.959	1+.075V/^{o}/SEC
	Y	0.957	0.961	
	Z	0.959	0.958	
RATE NORMAL	X	0.965	0.958	1$\pm$.075V/^{o}/sec
	Y	0.958	0.958	
	Z	0.957	0.958	
HOLD/ SLEW	X	0.049	0.049	0.050$\pm$.00375 V/ARC SEC/SEC
	Y	0.049	0.049	
	Z	0.0496	0.0495	

BIAS COMPENSATION

	AXIS	SPEC (H/S)	ACTUAL	
			MATRIX "A"	MATRIX "B"
RANGE (SEC/SEC)	X	NO REQUIREMENT	± 306	± 306
	Y		± 25.5	± 25.5
	Z		± 25.5	± 25.5
SCALE FACTOR (MATRIX OUTPUT) MV/°/HR	X	600 ± 45	595.2	595.2
	Y	50 ± 3.75	49.98	49.69
	Z	50 ± 3.75	50.01	49.97
RESOLUTION (SEC/BIT)	X	0.60	0.60	0.60
	Y	0.05	0.05	0.05
	Z	0.05	0.05	0.05

BODY RATE OUTPUTS - RIPPLE, NOISE, NONLINEARITIES

RATE COLD		DEVIATION FROM MEAN (VDC)			
AXIS	RATE(^{O}/S)	MATRIX A	MATRIX B	LIMITS (VDC)	
X	+1.0	.021	.001	A	.080
	-1.0	.019	.001		
	+2.5	.032	.001	B	.080
	-2.5	.025	.002		
	+5.0	.011	.006	(300 SEC/SEC)	
	-5.0	.037	.001		
Y	+1.0	.002	.001	A	.019
	-1.0	.003	0		
	+2.5	.004	.001	B	.019
	-2.5	.004	.001		
	+5.0	.007	.002	(72 SEC/SEC)	
	-5.0	.001	.003		
Z	+1.0	.002	.001	A	.019
	-1.0	.003	.001		
	+2.5	.003	0	B	.019
	-2.5	.002	.002		
	+5.0	.007	0	(72 SEC/SEC)	
	-5.0	.001	.004		

BODY RATE OUTPUTS - RIPPLE, NOISE, NONLINEARITIES

RATE NORMAL		DEVIATION FROM MEAN (VDC)			
AXIS	RATE(^{o}/SEC)	MATRIX A	MATRIX B	LIMITS (VDC)	
X	+1.0	.020	.003	A	.064
	-1.0	.001	.006		
	+2.5	.003	.007	B	.064
	-2.5	.016	.005	(240 SEC/SEC)	
	+5.0	.035	.017		
	-5.0	.030	.006		
Y	+1.0	.001	.002	A	.0106
	-1.0	.001	.001		
	+2.5	.002	.001	B	.0106
	-2.5	.003	.002	(40 SEC/SEC)	
	+5.0	.005	.001		
	-5.0	.001	.003		
Z	+1.0	.003	.001	A	.0106
	-1.0	.001	.002		
	+2.5	.003	0	B	.0106
	-2.5	.003	0	(40 SEC/SEC)	
	+5.0	0	.002		
	-5.0	.002	.001		

BODY RATE OUTPUTS - RIPPLE, NOISE, NONLINEARITIES

HOLD/SLEW		DEVIATION FROM MEAN (VDC)			
AXIS	RATE (SEC/SEC)	MATRIX A	MATRIX B	LIMITS (VDC)	
X	+25.0	.044	.012	A	.392
	-25.0	.009	.018	B	
	+50.0	.108	.024		.394
	-50.0	.001	.016	(8.0 SEC/SEC)	
	+100.0	.294	.012		
	-100.0	.139	.018		
Y	+25.0	.006	.002	A	.0346
	-25.0	.019	.003		
	+50.0	.018	.008	B	.0344
	-50.0	.012	.005	(0.7 SEC/SEC)	
	+100.0	.032	.013		
	-100.0	.005	.011		
Z	+25.0	.030	.001	A	.0347
	-25.0	.012	.001		
	+50.0	.010	.010	B	.0346
	-50.0	.030	.004	(0.7 SEC/SEC)	
	+100.0	.013	.007		
	-100.0	.028	.020		

MATRIX NULLS - X_{UP}, Y_{WEST}, Z_{SOUTH}

AXIS	MATRIX A	MATRIX B	STATE
X	-15 MV	+17 MV	RATE COLD (80°F) G-TEMP <1.5 VDC
Y	+3 MV	-3 MV	
Z	-2.5 MV	+1 MV	
X	-8 MV	+39 MV	RATE NORMAL (110°F) G-TEMP <2.4 VDC)
Y	+4.4 MV	-4.5 MV	
Z	-2.6 MV	-1.4 MV	
X	-16 MV	+44 MV	RATE NORMAL (135°F) G-TEMP STABILIZED
Y	+5 MV	-3 MV	
Z	-3 MV	-1.5 MV	
X	+290 MV	+620 MV	HOLD/SLEW (135°F) G-TEMP STABILIZED
Y	-12 MV	-63 MV	
Z	-522 MV	-516 MV	